



**TENDER NO: 2023/013**

**TENDER TITLE:**

**LOWER UMKHOMAZI BULK WATER SUPPLY SCHEME PHASE 2:**

**CONSTRUCTION OF THE WATER WORKS**

**VOLUME 3 of 3**

**Scope of Work, Site Information, Annexures**

**Issued by:**

uMngeni-uThukela Water  
310 Burger Street  
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**Tender Queries:**

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**Name of Tenderer:** .....

**National Treasury CSD Number:** .....

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### C3.1 STANDARD SPECIFICATIONS

The standard specifications on which this contract is based are the South African Bureau of Standards Standardized Specifications for Civil Engineering Construction SANS 1200 series. Although not bound in nor issued with this Document, the following Sections of the Standardized Specifications of SANS 1200 shall form part of this Contract:

*("SABS" has been changed to "SANS, without change to the contents of the specifications.)*

A	1986	-	GENERAL
AB	1986	-	ENGINEER'S OFFICE
C	1980	-	SITE CLEARANCE
D	1988	-	EARTHWORKS
DB	1989	-	EARTHWORKS (Pipe Trenches)
DK	1996	-	GABIONS AND PITCHING
DM	1981	-	EARTHWORKS (Roads, Subgrade)
G	1982	-	CONCRETE (Structural)
H	1990	-	STRUCTURAL STEELWORK
HA	1990	-	STRUCTURAL STEELWORK (SUNDRY ITEMS)
L	1983	-	MEDIUM PRESSURE PIPELINES
LB	1983	-	BEDDING (Pipes)
LC	1981	-	CABLE DUCTS
LD	1982	-	SEWERS
LE	1982	-	STORMWATER DRAINAGE
M	1996	-	ROADS (General)
ME	1981	-	SUBBASE
MF	1981	-	BASE
MM	1984	-	ANCILLARY ROADWORKS

The following SANS specifications are also referred to in this document and the Contractor is advised to obtain them from Standards South Africa (a division of SABS) in Pretoria.

SANS 1921 (2004): Construction and Management Requirements for Works Contracts  
Part 1: General Engineering and Construction Works;  
Part 2: Accommodation of Traffic on Public Roads Occupied by the Contractor;  
Part 5: Earthworks activities which are to be performed by hand;  
SANS 1921 (2004): Part 6: HIV/AIDS Awareness. (With regard to this specification, the payment clauses in the Bill of Quantities remain in accordance with the SABS 1200 series of specifications);  
SANS 1914 (2002): Parts 1 – 6;  
SANS 10400-T (2011): Fire Protection SANS 10400-W (2011): Fire Installation

#### **Preface on Interim Situation until Full Suite of SANS Series of Specifications are Available**

The Bill of Quantities is based on the SANS 1200 system of specifications and measurement.

Where SANS specifications are available, these have been incorporated into the "Contract" section of this document.

Where overlapping specifications from the SANS 2001 series of specifications occur the appropriate SANS 1200 specifications have been incorporated in the Project Specifications. In such cases, the requirements of the latter shall prevail over the requirements of the SANS specification(s).

The payment clauses in the Bill of Quantities are based on the SANS 1200 series of specifications for consistency and the Tenderer is required to ensure that he has priced all of the requirements pertaining to the SANS specifications.

Additional Specifications not issued to the tenderers.

**Not issued to Tenderer's, but available from the S.A. Federation of Civil Engineering Contractors, the S.A. Institution of Civil Engineering, the S.A. Bureau of Standards, the Government printers, the Construction Industry Development Board, and the Employer, as applicable:**

**APPLICABLE CODES AND STANDARDS USED**

The basis of the design process for the above-mentioned project will comply with the applicable legislation, regulation, standard and guidelines include – nota bene;

**Engineering Design/ Construction Standards**

STANDARD	DESCRIPTION
SANS 241-1:2015	Drinking Water Quality Standards
Act [No 43 of 2000]	Council for the Built Environment
Act [No 108 of 1997]	Water Services Act
Act [No 107 of 1998]	National Environmental Management Act
[EIA - 2014]	Environmental Impact Assessment Regulations
Act [85 of 1993]	Occupational Health and Safety Act
[E&SS/PS/Guide/14]	UMngeni-uThukela Water Process Design Guidelines
SANS 10400	National Building Regulations
SANS10142-1: 2020	Low Voltage wiring of premises: Part 1
SANS10142-2	Medium Voltage wiring of premises: Part 2
Act 103 of 1977	National Building Regulations and Building Standards Act
SANS 10160 - Part 1	Basis of Structural design and action for buildings and industrial structures Part 1: Basis of structural design
SANS 10160 - Part 2	Basis of Structural design and action for buildings and industrial structures Part 2: Self-weight and imposed loads
SANS 10160 - Part 3	Basis of Structural design and action for buildings and industrial structures Part 3: Wind actions
SANS 10160 - Part 4	Basis of Structural design and action for buildings and industrial structures Part 4: Seismic actions and general requirements for buildings
SANS 10160 - Part 5	Basis of Structural design and action for buildings and industrial structures Part 5: Basis of geotechnical design and actions
SANS 10100 - part 1 & part 2	Structural Use of Concrete
SANS 10100 - part 3	Design of Concrete Water Retaining Structures
DWS 0750	Water Retaining Concrete
BS 8007	Design of Concrete Structures for Retaining Aqueous Liquids
SANS 10162 - part 1 & part 2	Structural Use of Steel
SANS 10144	Detailing of Steel Reinforcement for Concrete
SANS 282	Bending Dimensions and Scheduling of Steel Reinforcement for Concrete
SANS 920	Steel Bars for Concrete Reinforcement
SANS 1024	Welded Steel Fabric for Reinforcement of Concrete
BS8110	Structural Use of Concrete
BS5950 - 1	Structural Use of Steelwork in Buildings

STANDARD	DESCRIPTION
EN 1991-1-4	Eurocode 1 Actions on Structures
API and ASME	Welding, Piping and Pipeline Standards
SANS 1200, 1921 & 2001	Construction Specifications
SANS 1200	Standardized Specification for Civil Engineering Construction
SANS 10252-1 2016	Water Supply Installations for Buildings
TRH 4 (1996)	Structural Design of Flexible Pavements for Internal and Rural Roads
TRH 14 (1985)	Guidelines for road construction materials
UTG 2 (1987)	Structural Design of Segmental Block Pavements for Southern Africa
UTG 10 (1990)	Guideline for the Geometric Design of Commercial and Industrial Local Streets
SANRAL	Road Drainage Manual
eThekweni Municipality Design Manual	Guidelines and Policy for the Design of Storm water Drainage and Storm water Management Systems

### GENERAL EQUIPMENT STANDARDS

STANDARD	DESCRIPTION
BS 5304	Code of practice for safeguarding of machinery
SANS 9096-1: 1994	Testing of welders, where applicable to the type of welding required
SANS 10162-4	Structural use of Steel Part 4: The design of cold-formed stainless steel structural
SANS 10044-3	Welding Part 3: The fusion of steel (including stainless steel): Tests for the approval of welding procedures
SANS 10044-4	Welding Part 4: The fusion welding of steel (including austenitic stainless steel): Tests for the approval of welders working where weld procedure approval is not required.
SANS 10064	The preparation of steel surfaces for coating
SANS 10102-4	Selection of pipes for buried pipelines Part 1: General Provisions
SANS 10104	Hand railing and balustrading (safety aspects)
SANS 1700	Fasteners
BS EN ISO 14847:1999	Rotary positive displacement pumps. Technical requirements
BS EN 734:1995	Pumps and pump units for liquids. Common safety requirements
BS EN 12162:2001	Liquid pumps. Safety requirements. Procedure for hydrostatic testing
BS EN 60041:1995	Field acceptance tests to determine the hydraulic performance of hydraulic turbines, storage pumps and pump-turbines.
BS EN 60994:1993	Guide for field measurement of vibrations and pulsations in hydraulic machines (turbines, storage pumps and pump-turbines)
BS EN 22858:1993	End-suction centrifugal pumps (rating 16 bar). Designation, nominal duty point and dimensions
BS EN 23661:1993	End-suction centrifugal pumps. Baseplate and installation dimensions
BS EN 733:1995	End-suction centrifugal pumps, rating with 10 bar with bearing bracket. Nominal duty point, main dimensions, designation system
SANS 1123	Pipe Flanges
ISO 281	Rolling bearings -- Dynamic load ratings and rating life
BS 4999	General requirements for rotating electrical machines. Specification for standard dimensions

<b>STANDARD</b>	<b>DESCRIPTION</b>
SIS 05 59 00	Pictorial Surface Preparation Standards for Painting Steel Surface
BS 5316 Part 2	Pump test codes
SANS 135	Isometric Bold Screws and Nuts (Lexagon & square/coarse thread free fit series)
SANS 136	Isometric Precision Hexagon Head Bolts and Screws and Hexagon Nuts (coarse thread medium fit series)
SANS 144	Cast Iron Single-door Reflux Valves
SANS 191	Cast Steel Gate Valves
SANS 192	Cast Steel Single-door Reflux Valves
SANS 664	Cast Iron Gate Valves for Waterworks and heavy Industrial Purposes
SANS 936	Cast Iron Spheroidal Graphite Iron Castings
SANS 1431	Steel
BS 3100	Cast Steel
BS 4504	Flange Drilling
BS 5155	Cast Iron and Carbon Steel Butterfly Valves
SANS 1123	Steel Pipe Flanges
SANS 9961-1-2000	Components of pressure pipe systems – Unplasticized Poly (vinyl Chloride) PVCu - pressure pipe systems
SANS 1849-1-2008	Butterfly valves for General Purpose
SANS 1551-1-2008	Check valves (Flanged and Wafer Types)

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## C3.2 AMENDMENTS TO STANDARD SPECIFICATIONS

### INTRODUCTION

In certain clauses the standard, standardized and particular specifications allow a choice to be specified in the project specifications between alternative materials or methods of construction and for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the project specifications. It also contains additional specifications required for this particular Contract.

The number of each clause and each payment item in this part of the project specifications consists of the prefix PS followed by a number corresponding to the number of the relevant clause or payment item in the standard specifications. The number of a new clause or payment item, which does not form part of a clause or a payment item in the standard specifications and which is included here, is also prefixed by PS, but followed by a new number which follows on the last clause or item number used in the relevant section of the standard specifications.

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## 1. SCOPE (CLAUSE 1)

No amendments.

## 2. INTERPRETATIONS (CLAUSE 2)

### 2.1 APPLICABLE EDITION AND STANDARDS (SUB CLAUSE 2.2)

Add at the beginning of Sub-clause 2.2:

"Unless a specific edition is specified (see the List of Applicable Specifications), ....."

### 2.2 DEFINITIONS AND ABBREVIATIONS (SUB CLAUSES 2.3 AND 2.4)

The terms "Schedule of Quantities" and "Bill of Quantities" shall be synonymous.

Except for references to the Bureau itself, or to the (official) SABS mark, the term "SABS" shall mean "SANS".

Add to Sub-clause 2.4(b):

"MAMDD: Modified AASHTO maximum dry density. TMH1: Technical Methods for Highways 1".

### 2.3 ITEMS IN SCHEDULE OF QUANTITIES (SUB CLAUSE 2.8)

#### 2.3.1 Principle (Sub clause 2.8.1)

In the fourth line of Sub clause 2.8.1 of SANS 1200 A, after the word "specification", add: "or in the measurement and payment clause of the standard specification, particular specification, project specification or any amendments thereto".

Add the following paragraphs:

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

- (a) the form and nature of the Site and its surroundings, including subsurface conditions,
- (b) the hydrological and climatic conditions,
- (c) the extent and nature of work and materials necessary for the execution and completion of the Works,
- (d) the means of access to the Site and the accommodation he may require

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

The Contractor shall be deemed to have based his tender on the technical data given in the Documents and, if in the performance of the Contract any circumstances shall differ from the said technical data, which difference causes delay or additional Cost, the Contractor shall be entitled to make a claim in accordance with Clause 10.1 of GCC2015.

The Contractor shall be deemed to have satisfied himself before tendering as to the correctness and sufficiency of his tender for the Works and of the rates and prices stated in the priced Bill of Quantities and the Schedule of Rates and Prices (if any) or in the specification, which rates and prices shall (except in so far as otherwise provided in the

Contract) collectively cover full payment for the discharge of all his obligations under the Contract and all matters and things necessary for the proper completion of the Works."

### **3. MATERIALS (CLAUSE 3)**

#### **3.1 QUALITY (SUB CLAUSE 3.1)**

Add to the Sub Clause:

"No used or recycled material may be used in the Works unless expressly authorised by the Engineer. Where a material to be used in this Contract is specified to comply with the requirements of an SANS Standard Specification, and such material is available with the official SABS mark, the material used shall bear the official mark.

Samples of concrete aggregates are to be delivered to an approved laboratory.

Where proprietary products are specified, the Contactor may propose equal alternatives for approval by the Engineer. Alternative materials or equipment proposed by the Contractor shall be tested. The test, as well as the materials or equipment, shall be approved by the Engineer prior to any such materials or equipment being built into the works and all costs involved in testing shall be deemed to be included in the rates tendered."

### **4. PLANT (CLAUSE 4)**

#### **4.1 SILENCING OF PLANT (SUB CLAUSE 4.1)**

Delete "in built up areas" in the second sentence and replace with:

"... in all areas within audible distance of residents (albeit urban, peri-urban or rural areas),...".

Add to the Sub Clause:

"In addition, the Contractor shall comply with Sub clause PSZB 8.1, as amended, of Particular Specification UW-002 Environmental Management of Construction Projects".

### **5. CONSTRUCTION (CLAUSE 5)**

#### **5.1 DRAWINGS AND DETAILS (NEW SUB CLAUSE 5.9)**

Tender drawings shall not be used for construction purposes. Construction drawings and additional detailed information will be made available to the Contractor as and when required by him.

The originals of all Drawings and Specifications prepared by or on behalf of the Engineer shall remain in his custody and references herein to delivery to the Contractor of Drawings or specifications shall relate to true copies thereof.

The Contractor shall be entitled to receive free of charge, to the extent provided in the Contract, copies of each such Drawing and specification and to receive, at the cost of reproduction, such additional copies as he shall reasonably require.

One copy of all documents constituting the Contract shall be kept on the Site and be available for perusal by the Engineer or any person authorised by him.

The Contractor shall, in accordance with the Engineer's instructions, maintain a register on the Site of all Drawings and revisions thereof in the chronological order in which they are delivered to him.

#### **5.2 SURVEY (SUB CLAUSE 5.1)**

BSC 557 Item 8.2

SCM 051 Ver 17

#### 5.2.1 Setting out of the Works (Sub clause 5.1.1)

Add to the Sub Clause:

"Before commencing any construction, the Contractor shall check the relative positions and levels of all reference pegs, bench marks and line pegs and inform the Engineer of any discrepancy.

The Contractor shall be responsible for the true and proper setting out of the Works and for the correctness of the position, levels, dimensions and alignment of all parts of the Works and for the provisions of all necessary instruments, appliances and labour in connection therewith.

The Contractor shall carefully protect and preserve all benchmarks, sight-rails, pegs and other things used in setting out the Works. For any new work the Contractor shall establish his own reference points from which the work can be set out.

The checking of any setting-out or of any line or level by the Engineer shall not relieve the Contractor of his responsibility for the correctness thereof.

If at any time during the progress of the Works, any error shall appear or arise in the position, levels, dimensions or alignment of any part of the Works, the Contractor, on being required to do so by the Engineer, shall at his own expense rectify such error to the satisfaction of the Engineer, but if such error is based on incorrect data supplied in writing by the Engineer or if there is any delay in providing the particulars required, the Contractor shall, in respect of that delay and the cost of such rectification, be entitled to make a claim in accordance with Clause 10 of GCC2010."

#### 5.2.2 As-built survey (New sub clause 5.1.3)

The Contractor shall supply the Engineer with as-built survey data for the entire Works (including invert and cover levels, coordinates of manholes and points of intersection, valve chambers, etc). The Completion Certificate will not be issued until the as-built survey information had been approved by the Engineer.

#### 5.2.3 Marker posts (New sub clause 5.1.4)

The Contractor shall supply and accurately place marker posts on the centreline of the buried pipelines, or as instructed by the Engineer. Marker posts shall be placed at all points of intersection, chambers and at a maximum spacing of 250 m. Marker posts shall be placed only once the pipeline, or any section thereof, has been successfully tested.

The co-ordinates, level and centreline distance (as determined from the as-built survey and drawings) of each marker post shall be accurately determined and recorded by the Contractor. All details shall be given to the Engineer in writing.

### 5.3 SAFEGUARDING AND ACCOMMODATION OF TRAFFIC (SUB CLAUSE 5.2)

With reference to Subclause 5.2 of SANS 1200 A the Contractor shall, in addition to the requirements of Subclause 5.1.6 of SANS 1200 D and the Amendments thereto, carry out and maintain such temporary works and provide all temporary road signs, as are necessary to maintain and safeguard the normal flow of public and private, vehicular and pedestrian traffic.

All temporary signs shall be of the type and size required for rural roads, as applicable, as specified in the "Southern African Development Community Road Traffic Signs Manual and Chapter 13, [Roadwork Signing] of the South African Road Traffic Signs Manual".

### 5.4 POLLUTION (SUB CLAUSE 5.6)

Add to the Sub-Clause:

“The Contractor shall comply with Sub clause PSZB 11 of Particular Specification UW-002 Environmental Management of Construction Projects”.

## 5.5 SAFETY (SUB CLAUSE 5.7)

Add to the Sub Clause:

“The minimum acceptable safety standards are as laid out in the latest version of the Occupational Health and Safety Act (Act 85 of 1993). The Contractor shall provide safety equipment for his workers as well as for up to 3 visitors to the site.

All work and particularly work carried out in the proximity of buildings, bridges, tanks or other structures shall be carried out in conformance with the regulations framed under the Occupational Health and Safety Act, 1993 and the Minerals Act, Act 50 of 1991, including shoring where necessary, to ensure the safety of structures that are at risk.

In addition, the Contractor shall comply with Sub-clause PSZB 7 of Particular Specification UW-002 Environmental Management of Construction Projects.

The Contractor shall make available for the duration of the contract 5 sets of safety helmets, safety shoes and gumboots and any other necessary safety equipment for sole use by the Engineer and his representative(s).”

## 5.6 GROUND AND ACCESS TO WORKS (SUB CLAUSE 5.8)

Add to the Sub Clause:

“The Contractor shall, during construction of the Works:

- a) improve and maintain to a standard that will ensure the safe execution of the Works, any existing access roads or roads built under this Contract and tracks required by him for the Works,
- b) keep all roads and access tracks used by him watered to minimise dust. The frequency of the watering shall be at least daily when roads and tracks are used by the Contractor, unless it is sufficiently damp after rain.

Immediately on completion of each section of the Works, the Contractor shall:

- a) reinstate all private roads used by him, other than those under (b) below, to at least their original condition,
- b) scarify all roads constructed by him for construction purposes and which are not required by the property owner or the Employer,

On completion of operations the Contractor shall restore the ground surface, wherever it may have been disturbed, to its original condition by filling in all ruts with material similar to the material within the rut and levelling the ground and, where necessary, planting grass and shrubs as may be required. Any boundary fences which have been removed or damaged by his operations and activities shall be repaired and/or reinstated at the Contractor's expense. Ground restoration must include proper placement of topsoil profile.

The relevant provisions of Sub clauses PSZB 2 and PSZB 13, and Clause PSZC, all of Particular Specification UW-002 Environmental Management of Construction Projects, shall apply.”

## 6. TOLERANCES (CLAUSE 6)

### 6.1 DEGREES OF ACCURACY (SUB CLAUSE 6.2)

Add to the Sub Clause:

“Generally, Degree of Accuracy II shall be applicable to the whole of the Works, unless specified otherwise (refer specifically to Amendments to SANS 1200 D and SANS 1200 G).”

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**PSA GENERAL (AMENDMENTS SANS 1200 A)**

**PSA 2 INTERPRETATION**

**PSA 2.3 DEFINITIONS**

Add the following under a) General:

- 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).

**PSA 3 MATERIALS**

**PSA 3.1 QUALITY**

Replace the second sentence of the first paragraph of Clause 3.1 with the following:

"Materials shall bear the official mark of the appropriate standard."

Add the following:

"The Contractor shall inform the Employer's Representative of any control testing to be done at least 48 hours before and must allow for the time required for testing, processing and approval in his programme."

**PSA 4 PLANT**

**PSA 4.2 CONTRACTOR'S OFFICES, STORES AND SERVICES**

Add the following to Clause 4.2:

**PSA 4.2.1 CONTRACTOR'S SITE FACILITY**

The Contractor shall establish his construction camp on a Site made available for this purpose by the Employer, or selected by him and approved by the Engineer. The camp shall be fenced off and shall contain all offices, stores, workshops, testing laboratories, toilet facilities, etc. The camp shall always be kept in a neat and tidy condition and, upon completion of the Works, the camp shall be removed and the Site cleaned and restored to its original condition as far as is practicable, unless otherwise specified in the Project Specifications

**PSA 4.2.2 SOURCE OF WATER SUPPLY**

Except as provided for in of the Particular Conditions of Contract, the Contractor is responsible under the Contract for the supply and distribution at his cost of all water that he may require for

purposes of constructing of the Works. Accordingly, the Contractor shall pay all consumption charges, and at his cost provide all connections, consumption meters, pipework, storage tanks, transport and other items associated with the supply of water for the Works. All connections to pipelines of a municipality (or its provider) shall be at points and to standards approved by the Engineer and that municipality or designated provider.

Connections to the local municipality's municipal network and the associated meter installations should be arranged with the local authority.

PSA 4.2.3 SOURCE OF POWER SUPPLY

The Contractor is 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 consumption charges, and at his cost to 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 requisite connection(s). The distribution of electricity shall be in accordance with the applicable bylaws and regulations of the supply authority.

PSA 4.2.4 SANITARY FACILITIES

The Contractor shall make his own arrangements for the provision of chemical toilets and other sanitary and water disposal facilities for his or his Subcontractor's staff. Ablution facilities shall be kept hygienic at all times. In addition, the Contractor shall at all times during construction of the Works provide adequate sanitary facilities on site so that all employees are at all times within easy reach of sanitary facilities. A connection to the existing sewer on the site will be allowed subject to approval by the local authority.

PSA 4.2.5 HOUSING

No housing is available for the Contractor's employees. The Contractor shall make his own arrangements to house his employees. The Employer shall place an area at the disposal of the Contractor to enable him to erect his site offices, workshops and stores. Any facilities shall comply with the requirements of the local authority, as well as conform to the OHAS Act and Health and Safety Regulations attached in this document. The Contractor shall provide his own fencing and site security.

PSA 4.2.6 FACILITIES FOR CONSTRUCTION WASTE

The Contractor shall make suitable enclosed containers available for the storage of all construction waste (i.e. whether it be in the camp or on the construction site). The Contractor shall ensure that these containers are emptied at the local solid waste site and a permit shall be obtained and presented to the Employer's Representative.

PSA 4.2.7 SECURITY

The cost for providing security against theft and vandalism will be held to be priced in section facilities for contractor (fixed and time related). The Contractor is responsible for all the work before the hand-over of the infrastructure. Minimum four armed Security guards and 4 other guards to be on site at during work hours including the manning of all site entrances/gates. Provision for security must be made which includes at least 2 guard houses at both entrances. Emergency response from private security company on radio link. 12 panic buttons to be supplied.



**PSA 5 CONSTRUCTION**

**PSA 5.1.1 SETTING OUT OF THE WORKS**

Replace the first sentence of this Clause with the following:

“The works shall be set out as shown on the Drawings. Benchmarks will be indicated to the Contractor during handing over of the site where applicable. The setting out of the works is the sole responsibility of the Contractor.”

Add the following to this Clause:

“Setting out of the Works will not be measured and paid for directly, and compensation for the work involved in setting out shall be deemed to be covered by the tendered rates for the various items of work included under the contract.”

**PSA 5.2 WATCHING, BARRICADING AND LIGHTING**

Add the following:

“The Contractor shall comply in all aspects with the requirements of the Occupational Health and Safety legislation”.

**PSA 5.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES**

Add the following:

“The Contractor shall as soon as possible after handing over of the site, commence with the detection of existing services and finalise his investigation at least 7 days prior to commencement of any excavation works. Services must be verified, measured and surveyed on site and indicated on a set of construction drawings for review by the Engineer. No additional payment shall be applicable to the location, verification and recording of existing services. Where on account of location or level, existing services have to be permanently altered to accommodate the proposed Works, the Employer will pay all charges in connection therewith, unless it has already been provided for in the Schedule of Quantities.”

**PSA 5.5 DEALING WITH WATER ON WORKS**

Add the following:

“All water, whether from rain, floods, pipeline failures, or subsurface water and infiltration shall be dealt with in such a way as to ensure the safety of the Works. It is required that adequate preventative measures are taken, and maintained to ensure that the Works is protected from damage due to water from any source.

In the event of these measures failing to protect the Works, action shall be taken immediately to protect the Works from further damage, the costs of which shall be carried by the Contractor. The damage caused shall be made good by those responsible for the damage, or as directed by the Engineer. The costs of the work shall be carried by the responsible party.

The Contractor shall design, construct and maintain all drains, pumps, well points and other temporary works necessary for the dewatering and flood protection of the permanent works. All methods of dewatering and flood protection shall be to the approval of the Engineer.

Having served their purpose, all temporary works shall be removed, backfilled or levelled such that

the operation of the works shall not be affected in any way.

The Contractor shall be responsible for and shall repair at his expense any damage to the foundations, structures or any part of the Works caused by floods, water or failure of any part of the dewatering and flood protection works.

The cost of all flood protection and dewatering measures, shall be included in the relevant Preliminary and General items in the Schedule of Quantities.”

**PSA 5.6 POLLUTION**

The Contractor’s attention is specifically drawn to avoiding dust nuisance.

**PSA 5.9 ACCOMMODATION OF TRAFFIC**

Add the following:

“Temporary traffic signs shall be erected at all diversions or excavations on public and private roads. Traffic signs shall have a yellow background with either a red or black border and shall comply with the Local Authority requirements and standards.”

**PSA 7 TESTING**

**PSA 7.1.1 CHECKING**

The Engineer’s Representative requires 48 hours’ notice from the Contractor when each stage listed below is reached in order to perform the relevant inspection and/or acceptance test:

i) Pipe trenches

The Engineer will visually inspect excavations before placement of bedding material. The Engineer will perform density acceptance tests in pipe trenches on the bedding layers, selected backfill and backfill at 300 mm intervals. The Contractor shall notify the Engineer when the pipe trench has been excavated and when each 300 mm increment of backfill has been completed.

ii) Pipework

The Engineer will visually inspect all anchor blocks and pipework before covering up. The Contractor shall notify the Engineer when the pipeworks are ready, before covering up. The Contractor shall perform pressure tests in the presence of the Engineer after the trench has been partially backfilled. Joints and fittings are to remain exposed.

The Contractor shall retest the completed pipelines in the presence of the Engineer on completion of all the Works.

iii) Structures

The Engineer will visually inspect excavations and preparation for foundations, tied reinforcement before erection of the formwork and the erected formwork for each structural element that is to be cast separately. The Contractor shall notify and obtain the Engineer’s approval when each relevant stage is complete. Cubes shall be taken on all pours in accordance with SANS 1200 and Clause PSG 7.1.2.

iv) Roadworks and earthworks

Subgrade and fill:

The Engineer will perform density acceptance tests on subgrade and fill. The Contractor shall

notify and obtain the Engineer's approval when each 300 mm increment of fill is complete and upon completion of the subgrade before placement of layerworks.

Subbase and base:

The Engineer will perform CBR tests, Atterberg limits and grading analyses on subbase and base samples taken off stockpiles on site. The Contractor shall notify and obtain the Engineer's approval after delivery of material to site before commencing with mixing and compaction.

The Engineer will perform density acceptance tests on the completed subbase and basecourse layers. The Contractor shall notify and obtain the Engineer's approval on completion of the subbase before proceeding with construction of the basecourse layer."

### PSA 7.3 METHOD OF TESTS

Add the following:

"All compaction density testing carried out by the Contractor shall be performed using a Nuclear Density Test Gauge. The Contractor shall obtain, calibrate and make available a Nuclear Test Gauge on site for the duration of the Contract."

### PSA 7.4 STATISTICAL ANALYSIS OF CONTROL TESTS

Add the following:

"Test results shall not be evaluated by statistical methods and analysis. All results shall comply with the specified minimum requirements applicable."

### PSA 7.5 GENERAL

Add the following:

All test results obtained by the Contractor in the course of his process control of the Works shall be submitted to the Engineer or his Representative prior to requesting inspection of the relevant portions of the Works.

The Contractor shall make suitable arrangements for process control prior to commencement with the Works. Should he intend using site personnel for this purpose he shall ensure that suitably trained and competent personnel take charge of the necessary test work, and that the necessary equipment is at their disposal prior to commencement of the Works. Failure to comply with these requirements shall be just cause for the Engineer to order suspension of the Works without additional remuneration in terms of Clause 5.11 of the Conditions of Contract, or for him to recommend termination to the Employer in terms of Clause 9 thereof.

The Contractor shall deliver to the Engineer, for his consideration, quality assurance programmes (as obtained from all the Contractor's proposed suppliers of pipes, valves and specials) prior to the Contractor's appointment of any suppliers.

## PSA 8 MEASUREMENT AND PAYMENT

### PSA 8.2 PAYMENT

#### PSA 8.2.5 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  $\frac{\text{Extended contract period as authorized by variation order}}{\text{Tendered contact period}}$

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

The above-mentioned adjustment of payment for time-related items shall be made in the Completion Payment Certificate and shall be the only payment for additional time-related costs.

**PSA 8.3.1 CONTRACTUAL REQUIREMENTS**

Add to sub-clause:

"In addition, the sum tendered shall cover all initial costs incurred in complying with the requirements of the Special Conditions of Contract."

**PSA 8.3.4 REMOVAL OF SITE ESTABLISHMENT**

Add to sub-clause:

"The sum shall not be less than 15% of the total value of the tendered sums under Payment Clause 8.3.2: Establishment of facilities on the Site."

**PSA 8.4 SCHEDULED TIME-RELATED ITEMS**

**PSA 8.4.1 CONTRACTUAL REQUIREMENTS**

Add the following:

The Contractor shall tender a lump sum in the Schedule of Quantities to cover his time-related establishment costs. The amount tendered and paid shall be full compensation to the Contractor for:

- (i) The maintenance of his whole organisation as established for this Contract.
- (ii) The maintenance of all insurances, indemnities and guarantees required in terms of the Conditions of Contract or Tender where applicable.
- (iii) Compliance with all general conditions and requirements which are not specifically measured elsewhere for payment in these Contract Documents.

The Contractor shall tender a lump sum for the abovementioned items. Payment of the lump sum shall be made monthly in compliance with the method laid down in Sub-clause 8.2.2 of SANS 1200A.

The Contractor will not be paid Time-Related Preliminary and General charges for any Special Non-Working Days, as stipulated in the Appendix, which shall be deemed to have been allowed for in his rates.

**PSA 8.5 SUMS STATED PROVISIONALLY**

Add to this clause:

**PSA 8.5.1 CONTINGENCIES**

A Provisional Sum has been included in the Summary of Schedules for contingencies. No percentage mark-up will be applicable to any payments made using the contingency amount other than the mark up included in prices for variations determined in terms of the Conditions of Contract.

#### PSA 8.5.2 CONTRACT PRICE ADJUSTMENT

A Provisional Sum shall be included for Contract Price Adjustment in the Summary of Schedules to make provision for contract price adjustment in terms of the Conditions of Contract. The value of the Provisional Sum shall be based on the percentage of the subtotal value as specified in the Summary of Schedules. No percentage mark-up will be applicable to any payments made in this regard.

#### PSA 8.5.3 COMMUNITY LIAISON OFFICER

A Provisional Sum has been included for a salary to be paid to the Community Liaison Officer. In addition to the abovementioned amount, provision is made for a mark-up on the amount to be paid. This mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract. The Contractor shall make allowance for the employment of a CLO in accordance with the following terms of reference (TOR).

Terms of Reference for the CLO:

The Community Liaison Officer (CLO) will be responsible to the Project Steering Committee (PSC), who will be involved in the appointment of the CLO. The CLO should be the person with a good standing and respect in the local community and would be selected according to the set criteria by the interviewing panel consisting of Local and District Municipality, ISD Consultant, PSC, Ward Councillor and selected local leadership.

The CLO is appointed for the period of physical construction, plus a period of 14 days prior to this period. The period will include times where small team works are busy in the area e.g. chambers, standpipes and trenches. The period will end when no further work is required. The contractor will provide office space and stationery for the CLO to carry out his / her duties.

Remuneration for the CLO will be minimum wage or specified by client per month for the period of employment. Where the CLO is engaged for part of the month, they shall be paid an equivalent daily amount. The unit for measurement shall be the man-month of CLO employment. A CLO who fails in their responsibilities may be replaced in consultation with the PSC and ISD consultants.

The contractor is required to have in his employ a labour relations officer that will be responsible for the induction of all site labour/employees that have signed contracts with the contractor, he will monitor and chair all labour related disputes, employee strikes and disciplinary hearings as per the requirements of the Department of Labour.

#### **THE ROLES AND RESPONSIBILITIES OF THE COMMUNITY LIAISON OFFICER (CLO)**

- Be at the forefront of all community engagements and liaison, be part of project team and liaise directly with community on behalf of the project. No project team member shall liaise with community structures and members in the absence of the CLO
- Coordinate community activities with respect to construction works activities and inform community regarding the project goals and outcomes..
- Arrange venues for community meetings and training if required.
- Assist with relocation of people, where applicable.
- Maintain an up-to-date database of potential labour and local businesses within the community and provide the contractor with copies of this information.
- To identify, screen and nominate labour from the community in accordance with the contractor's requirements and determine, in consultation with the contractor, the needs of local labour for employment and relevant technical training, where applicable.
- Liaise between contractor and labour regarding wages and conditions of employment.
- Identify possible labour disputes, unrest, strikes, etc., in advance and assist in their resolution

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- Inform local labour of their conditions of temporary employment, and inform them timeously of their termination period as instructed by the contractor.
- Attend disciplinary proceedings to ensure that hearings are fair and reasonable.
- Educating community with regard to the dispute resolution mechanism adopted and recorded in the agreement between the employer and the Project Steering Committee
- Facilitating labour, community and contractor concerns; and providing daily feedback regarding community concerns to the contractor

PSA 8.5.4 RELOCATION OF EXISTING SERVICES

A Provisional Sum has been included for the relocation of existing services if and when required.

PSA 8.5.5 TRANSPORTATION FOR THE ENGINEER

The Contractor shall pay the Engineer, on the monthly invoice of the Engineer; the rate per month stated in the Bill of Quantities and shall recover the same from the Employer in the monthly payment certificate. The Contractor's overheads and profit on the above monthly payments will be paid under the payment items provided at the tendered percentage mark-up on the actual payments made.

PSA 8.5.6 ACCOMMODATION FOR THE ENGINEER'S STAFF

The Contractor shall pay the Engineer, on the monthly invoice of the Engineer; the rate per month stated in the Bill of Quantities and shall recover the same from the Employer in the monthly payment certificate. The Contractor's overheads and profit on the above monthly payments will be paid under the payment items provided at the tendered percentage mark-up on the actual payments made.

PSA 8.5.7 ENGINEER'S STAFF EQUIPMENT

The Contractor shall pay the Engineer, on the monthly invoice of the Engineer; the rate per month stated in the Bill of Quantities and shall recover the same from the Employer in the monthly payment certificate. The Contractor's overheads and profit on the above monthly payments will be paid under the payment items provided at the tendered percentage mark-up on the actual payments made.

PSA 8.5.8 SERVICE CONNECTIONS

Prov Sum have been included for obtaining electrical, water and sewer connections from the local authority, for the respective erven. Payment will be based on the actual invoicing from the local authority to the Contractor. In addition to the abovementioned amount, provision is made for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA 8.5.9 ACCEPTANCE CONTROL TESTING

A Provisional Sum has been included for acceptance control testing ordered by the Engineer to be undertaken by a commercial laboratory. Payment will be based on the actual invoicing by the laboratory to the Contractor. In addition to the abovementioned amount, provision is made for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

PSA 8.5.10 ENVIRONMENTAL AND POLLUTION MONITORING EQUIPMENT



A Provisional Sum has been included for the Employer to operate and maintain climate and environmental monitoring equipment on the boundary wall, for use during this contract.

**PSA 8.6 PRIME COST ITEMS**

**PSA 8.6.1 LABORATORY EQUIPMENT**

PC Sum have been included for obtaining laboratory equipment. Payment will be based on the actual invoicing from the local authority to the Contractor. In addition to the abovementioned amount, provision is made for a mark-up on any payments made by the Contractor in this regard. The mark-up shall be regarded as full compensation for overheads, charges and profits as provided for in the Conditions of Contract.

**PSA 8.7 DAYWORKS**

Add the following clauses:

**PSA 8.7.1 MATERIALS FOR DAYWORKS**

A Sum has been included for materials to be used during the execution of dayworks. In addition to the abovementioned amount, provision is made for a mark-up on the cost of materials used during the execution of the dayworks by the Contractor. Payment made shall be regarded as full compensation for overheads, charges and profit on the materials that are used when executing dayworks.

**PSA 8.8 TEMPORARY WORKS**

**PSA 8.8.2 ACCOMMODATION OF TRAFFIC**

Unit: Sum

Add the following:

The sum tendered shall include full compensation for all requirements in terms of the general control and accommodation of traffic during construction and for the supply, erection, moving and removing of temporary road signs for use at all traffic deviations around the site and on public roads used for the transport of excavated/fill materials.

The rate shall also include the cost of flagmen and any traffic warning signs as may be required during the construction period including full time flagmen at all entrances to the site."

Add the following clause:

**PSA 8.9 ENVIRONMENTAL MANAGEMENT**

**PSA 8.9.1 COMPLIANCE WITH ENVIRONMENTAL SPECIFICATION**

Unit: Sum

The sum tendered shall be full compensation for general compliance with the Construction Environmental Management Programme. Compensation shall include for the preparation of Method Statements and other related documentation to demonstrate to the Engineer the steps and procedures that the Contractor will follow and implement to ensure compliance with the Environmental Specification.

Add the following clause:

**PSA 8.10 OCCUPATIONAL HEALTH AND SAFETY**

Add the following:

**OCCUPATIONAL, HEALTH AND SAFETY ACT 85 OF 1993 AS AMENDED BY THE OCCUPATIONAL HEALTH AND SAFETY AMENDMENT ACT 181 OF 1993.**

Contractors must comply with the provisions of the above-mentioned Act and other applicable legislation. Particular attention must be paid to Section 16 of the Act.

**Appointment of Responsible Person**

(i) The Contractor shall cause work to be carried out under the general supervision of a Responsible Person appointed by the Contractor in writing in accordance with the provisions of the Regulations made in terms of the Occupational, Health and Safety Act 85 of 1993 as amended the Occupational, Health and Safety Amendment Act 181 of 1993.

(ii) A copy of the letter of appointment and of the appointees written acceptance thereof shall be lodged with the Engineer BEFORE any work on site shall commence.

(iii) In addition, the Contractor shall provide the Engineer with the name or names of any Health and Safety Representatives appointed in terms of Section 17 of the above-mentioned Act and who has been given the responsibility of any site or sites falling under the terms of the Contract.

(iv) Whenever the appointed Responsible Person is replaced by another person, the replacement must be appointed, and a copy of the appointment submitted to the Engineer.

The maintenance of safe work practice at all times and in all sections of the execution of the works is embedded in the day to day site activities of all the Contractor's management, staff and workforce on the contract. However, the introduction of the Construction Regulations in 2003 requires from the Employer to ensure that the Contractor has made adequate provision for the execution of the works within the specifications of said regulations. It must be noted that the lists below are not exhaustive and that many items have been traditionally priced by the Contractor as an integral part of his Preliminary and General items or as part of the overhead costs of other items. The tender document, although not detailed with regards the Construction Regulations, requires that the Contractor ensures adherence to the Occupational Health and Safety Act (Act 85 of 1993) the Construction Regulations, 2003.

**PSA 8.10.1 HEALTH AND SAFETY PLAN ..... Unit: Sum**

The Contractor shall include in the tendered sum all cost associated with the preparation of a Health & Safety Plan. Payment shall be made once the Health & Safety Plan has been approved by the Employer's Agent. The fixed charge item shall include but shall not be limited to the following:

- Preparation of Health and Safety Plan
- Establishment of Health and Safety File
- Health and Safety Training
- Personal Protective Clothing and Equipment
- Fences, Signs and Barricades
- Establishment of Safety Administration on Site



**PSA 8.10.2 HEALTH AND SAFETY COMPLIANCE..... Unit: Sum**

The Contractor shall include in the tendered sum all costs associated with the compliance to the Occupational Health and Safety Act (Act 85 of 1993) and its Regulations and with the Employer's Health and Safety Specification. The cost of maintaining a Health & Safety file shall be included. The sum tendered shall cover all costs for the duration of the contract and shall be measured as a time-related amount payable by month.

The time related item shall include but shall not be limited to the following:

- The employment cost of all health and safety personnel including consultants, health and safety officers, inspectors, supervisors and issuers required in terms of the Contractor's Health and Safety Plan,
- Updating the Health and Safety Plan as needed,
- Carrying out of periodic own audits and follow-up audits,
- Compiling ongoing risk assessments and risk assessment reports as required by the Works,
- Convening of regular safety meetings with the Safety Representatives,
- Accompanying and supporting the Employer or his Safety Agent during ad hoc audits,
- Compilation of monthly safety reports and statistics for the Employer or his Safety Agent,
- Implementation and maintenance of Training
- Maintenance of personal protective clothing and equipment
- Maintenance of fences, signs and barricades
- Implementation and maintenance of safety administration
- Other Health and Safety Time-related Obligations

**PSA 8.11 MENTORING AND TRAINING OF CPG ..... Unit: Sum**

The Contractor shall include in the tendered sum all costs associated with training and mentoring of the CPG partner and its legislation, Regulations with regard to construction. The cost of maintaining good relationship and teach construction skills and techniques throughout the contract. The sum tendered shall cover all costs for the duration of the contract and shall be measured as a time-related amount payable by month.

**PSA 8.12 PERFORMANCE MONITORING OF SERVICES PROVIDER..... Unit: Sum**

The Contractor shall include in the tendered sum all costs associated with monitoring all service providers and submit monthly progress report. The performance of service providers that have been selected to provide assistance in the provision of a municipal service, otherwise than in circumstances where Chapter 8 of the Municipal Systems Act applies, is required, by Section 116 of the Municipal Finance Management Act, to be monitored and reported on (see Cl.53 of the SCM Policy).

Appropriate key performance indicators (KPIs) for the contract must be set by the Municipality as a yardstick for measuring performance.

This will be agreed with the Employer prior to commencement of the contract.

**PSA 8.13 PHOTOGRAPHIC RECORDS ..... Unit: Sum**

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The Contractor shall include in the tendered sum all costs associated with the compliance to taking all photographic evidence of daily site work, date and time specific , save on to a hard drive and submitted to engineer The cost of maintaining a photographic evidence shall be included. The sum tendered shall cover all costs for the duration of the contract and shall be measured as a time-related amount payable by month.

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**PSAB ENGINEER'S OFFICE (AMENDMENTS SANS 1200 AB)**

**PSAB 3.2 OFFICE BUILDINGS**

Add to this clause:

In addition to the listed office, the following must be provided:

All offices, facilities and equipment shall be new and be furnished, serviced, cleared and maintained by the Contractor.

*The Contractor shall supply and furnish eight (8) air-conditioned "IVS Container executive office" or Similar approved (six for the use of the Engineer and his /her staff and two for the Employers' inspectors) and one air-conditioned "IVS Container office" or Similar approved conference facility for conducting meetings.*

Add to the Sub-clause:

**In addition to the furnishings listed under sub-items (a) to (i), the following shall be provided and properly maintained:**

- a) one refrigerator of at least 100 litre capacity
- b) one kettle of at least 2 litre capacity
- c) one tea set comprising six cups and saucers, six teaspoons, one teapot, one sugar bowl and one milk jug
- d) covered parking for four vehicles
- e) un-covered parking space for two vehicles
- f) two "Barhold" or similar wall mounted racks each with 6 clamps suitable for hanging A0 sized drawings
- g) one large meeting table
- h) ten additional chairs
- i) Air conditioning unit with 2.2 kW minimum capacity mounted and with own power connection
- j) Extractor fans installed complete with own power connection
- k) Fire extinguishers, 9.0kg, all-purpose dry powder type complete with mounted on wall brackets
- l) 220/250 volt power points
- m) 400/231 volt 3-phase power points
- n) Double 80-watt fluorescent light fittings or LED complete with ballast and tubes.
- o) Venetian blinds

A meeting room as follows:

- Minimum internal Floor area of 12 m<sup>2</sup>
- Meeting table to accommodate a minimum of 10 people
- Office chairs for a minimum of 10 people
- Air conditioning unit with 2.2 kW minimum capacity mounted and with own power connection
- Extractor fans installed complete with own power connection.
- Fire extinguishers, 9.0kg, all-purpose dry powder type complete with mounted on wall brackets

Covered parking Bays as follows:

- Concrete block paved and covered parking for two vehicles

Please note that there is a provisional sum for an electrical supply point to be provided by others.

**PSAB 4 TELEPHONE / DATA LINE**

Delete the Sub-Clause and substitute the following:

The Contractor shall provide a telephone / data / VOIP / internet connection (fibre 20MB/S) - with twelve (12) extensions for the sole use of the Engineer or his Representative. The provision of a direct independent telephone line for the Engineer, including the cost of all calls in connection with contract administration and telephone rental. Handling Cost for the point mentioned above.

Add the following Clause:

**PSAB 5 NAME BOARDS (Clause 3.1)**

Add the following to Clause 3.1:

Contract Drawings for a detailed drawing of the name board. Two name boards shall be supplied by the Contractor which shall conform to the detail drawing appended to this document. The Contractor shall be responsible for the erection thereof, maintenance during the contract period and removal on completion at the end of the Defects Liability Period.

**PSAB 6 SURVEY ASSISTANTS (Clause 5.5)**

One suitably educated Survey Assistant shall be made available for the sole use of the Engineer's Representative for the duration of the Contract. The assistant may also be required to fulfil the function of Community Liaison Officer during the Contract should the Engineer consider this arrangement to be in the interests of the Employer. The Survey Assistants may therefore have to be appointed from the local communities. Transport shall be supplied for the Survey Assistant/Community Liaison Officer by the Contractor for the duration of the Contract should he be requested to do so.

**PSAB 7 SURVEY EQUIPMENT**

The survey equipment listed below shall be made available and be maintained in good condition for the exclusive use of the Engineer or his Representative for the duration of the Contract. Payment will be made as provided for in the Time Related Items included in Schedule 1.

- |     |   |       |
|-----|---|-------|
| (a) | Automatic surveyor's level complete with tripod and leather carry case such as Zeiss N1-2 or equivalent                     | 1 No. |
| (b) | 20-second tachometer with optical plumbob complete with tripod and leather carry case such as Sokkisha TM20C or equivalent. | 1 No. |
| (c) | Nylon-coated steel surveyor's tape 100m long and 10mm wide  | 1 No. |
| (d) | 5m long steel tape  | 1 No. |
| (e) | 5m long three-piece telescopic survey staves (metric double-face) complete with angle bracket level                         | 2 No. |
| (f) | Survey books: Level   | 3 No. |
| (g) | 2kg hammer with rubber handle   | 1 No. |

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(h)	Steel pegs, 300mm long and 12mm dia	10 No.
(i)	Aluminium tags, 100mm long, 15mm wide and 2mm thick	10 No.
(j)	Measuring wheel	1 No.
(k)	Tripod holders for ranging rods (heavy duty)	2 No.
(l)	Optical square (Sokkisha or Wild), complete with telescopic aluminium rod and bubble	1 No.
(m)	Triangular change plate with chain	2 No.
(n)	100m long 50 kg strength fish line	1 No.
(o)	One metre long spirit level	1 No.
(p)	Three metre aluminium straight edge	1 No.

The Contractor shall keep the equipment continuously insured against any loss, damage or breakage, and he shall indemnify the Engineer against any claims in this regard. The Contractor shall also maintain the equipment in good working order throughout the Contract period.

**PSAB 8 ELECTRONIC EQUIPMENT**

The Contractor shall also supply the following equipment for the duration of the Contract.

- a) A Troxler nuclear system complete with accessories and stored in a suitable transit case as supplied by the manufacturer. A detailed description of each unit and principles of operation should be given in the manual for the nuclear instrument.
- b) The Contractor shall also provide, insure and maintain for the full duration of the contract an approved 4 x digital camera (100MP) complete with zoom features.
- c) All Engineers and client's offices to be supplied with 12 laptops as well as Internet connection access of minimum 20MB/s fibre connection or equivalent. Laptops to be Dell 5410 i9(1195g9 processor), 16GB RAM, 512GB SSD minimum. Drawing office to include an A3 size lazer colour printer/scanner as well as one A0 plotter.
- d) The Engineer's office and Client's office shall be equipped with a backup power system with a capacity of 3x6 kVA using either a UPS/Inverter system with a battery power supply or a UPS in combination with a SOLAR/Generator system to ensure uninterrupted power supply to the offices, air conditioners and all office facilities and equipment in the event of power outages due to load shedding.

**PSAB 9 CARPORT**

The Contractor shall also supply and maintain four corrugated iron covered carports with closed sides and graveled floor for the sole use of the Employers Agents Representative and the Employer. The Contractor shall provide and maintain two carports with waterproof roofing for the duration of the Contract. The floor shall consist of crushed aggregate to alleviate dusty and muddy conditions.

**PSC SITE CLEARANCE (AMENDMENTS SANS 1200 C)**

**PSC 3 MATERIAL**

**PSC 3.1 DISPOSAL OF MATERIAL**

Suitable Landfill sites for the disposal of material shall be procured by the Contractor and shall be approved by the Engineer prior to use. Such a site shall have the approval of the Engineer, the Local Authority and the Environmental Officer

Disposal of combustible material by burning will not be permitted.

No overhaul will be payable on the disposal of material arising from clearing and grubbing and/or removing existing fencing or structures, and Landfill fees must be included in the rates.

**PSC 5 CONSTRUCTION**

**PSC 5.1 AREAS TO BE CLEARED AND GRUBBED**

The areas to be cleared and grubbed will be indicated by the Engineer. All trees outside the designated area to be cleared shall be preserved.

Trees with a trunk girth of more than 1m shall be measured and approved by the engineer prior to being removed. Written permission of the Engineer is required.

**PSC 5.2.3 PRESERVATION OF TREES**

The penalty in respect of every individual tree, designated as a tree to be preserved, that is damaged or removed unnecessarily by the Contractor, shall be R1000. Trees that fall within areas upon which the Works are to be constructed or within areas that the Contractor must occupy for the proper construction of the Works will not be designated for preservation.

**PSC 5.5 RECLEARING OF VEGETATION**

Any costs incidental to the re-clearing of vegetation, should this be necessary or so ordered by the Engineer.

**PSC 5.6 CONSERVATION OF TOPSOIL**

Add the following:

The topsoil, where approved by the Engineer, shall be conserved for later use by stockpiling in stockpiles clear of the working area.

The topsoil up to a depth of 150mm, if available and approved by the Engineer, shall be removed from the above specified cleared areas and stockpiled not higher than 2m on approved sites for later reuse. Until required for spreading, the stockpiles of topsoil material shall be stabilized by watering or other approved means to limit dust pollution.

When in the opinion of the Engineer, there is an insufficient quantity of topsoil available as a result of the Contractor's failure to comply with the above, the Contractor shall import approved topsoil at his own cost."

**PSC 8 MEASUREMENT AND PAYMENT**

BSC 557 Item 8.2

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**PS C 8.2.8 Removal of structures.....Unit : Sum**

The cost shall cover the breaking down of the structure, including underground foundations; the loading, removal, transport and disposal at approved Landfill sites procured by the Contractor. The rate should also include the Landfill fees.

**PS C 8.2.9 Installation of fences.....Unit : Sum**

The cost shall cover the complete installation of fences, including underground foundations; the transport, supplying, loading, and installation of fence complete with all necessary accessories, procured by the Contractor. The rate should also include setting out, excavation, compaction, foundations, fixing and installation complete.

**PSC 8.2.10 Topsoiling**

**Add the following to this Clause:**

The topsoiling will be measured by surface area covered.

“The rate tendered for the removal of in situ topsoil shall also cover the cost of stabilizing and protecting the stockpiles of topsoil.

The rate for topsoiling shall also cover the cost of loading, hauling, spreading to a compacted thickness of 150 mm and making suitable provision to avoid the topsoil slipping down the slopes of embankments and cut-slopes, all to the approval of the Engineer.”

**PSC 8.2.11 Alien Plant and Weeds Management .....Unit: Sum**

The sum tendered shall be full compensation for general compliance with the Construction Environmental Management Programme. Compensation shall include for the preparation of Method Statements and other related documentation to demonstrate to the Engineer the steps and procedures that the Contractor will follow and implement to ensure compliance with the Environmental Specification.

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**PSD EARTHWORKS (AMENDMENTS SANS 1200 D)**

**PSD 3 MATERIALS**

**PSD 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES**

**PSD 3.1.2 Replace Sub-clauses 3.1.2 (a), (b) and (c) with the following:**

All material encountered in any excavations for any purpose including restricted excavations will be classified as follows:

1. Excavation in all materials, excluding hard rock. This category of excavation includes; excavation in all sandy and disturbed material; in clay; in undisturbed and weathered Shale (clay); Sandstone; Mudstone and in all rippable rock.
2. Excavation in hard rock will require the use of a hydraulic breaker or rock splitting. Areas deemed to require excavation in hardrock will be as agreed on site with the Engineer.

Extra-over payment will be made for hard rock excavation provided the surface levels of the hard rock have been recorded on drawings signed by the Engineer before it is excavated.

**Other earthworks**

Non-plastic sandy material from excavations shall be used in the following order:

1. As selected granular material for pipe bedding.
2. As blanket and backfill to pipe trenches.
3. As backfill to structures.
4. As spoil stockpiled in selected areas indicated by the Engineer.

The Contractor shall employ selective methods of excavation to obtain topsoil, and material suitable for backfill, embankments, pipe bedding, selected granular material, road construction and bulk earthworks platforms.

**PSD 3.1.2 c) HARD ROCK EXCAVATION**

Add the following:

“Hard Rock Excavation in all excavations shall be excavation in solid material occurring in bulk, banks, ledges or trenches, which cannot be efficiently loosened and excavated by means of a 42 tonne back-acting excavator and which necessitate the use of explosives or drilling, wedging and splitting. All hard excavation shall be approved by the Engineer or his Representative in writing prior to excavation.

Rock quantities are to be measured and agreed with the Engineer prior to backfilling. In the event that backfilling has taken place before rock quantities have been agreed with the Engineer then no rock payment will be made.”

Crushed Stone and Natural Gravel (G5 and G7)

Unit : m<sup>3</sup>

Aggregate of G5 and G7 quality may be obtained from natural gravel and boulders on site that may require crushing. The classification of the material as being G5, or G7 is determined by the soaked CBR of the material. The plasticity index (PI) may be adjusted by the addition of small quantities of lime, cement, or sand.

Natural Gravel of G5 quality should have a maximum aggregate size of 63mm or two-thirds of the compacted layer thickness, whichever is smaller. A minimum grading modulus of 1.5 for G5 quality should be obtained compacted to 95% Mod AASHTO. PI not to exceed 10.



Gravel-soil of G7 quality should have a maximum size of 75mm, in place, after compaction, not greater than two-thirds of the compacted thickness of the layer. A minimum grading modulus of 0.75 should be obtained compacted to 93% Mod AASHTO. PI not to exceed 12.

The Engineer shall have full control of the use of all material produced by excavation and process method but the Contractor shall so plan his operations, and in particular his excavation to fill operations, that all excavated material can be used to the best economical advantage to the Employer. This would mean that no material shall be unnecessarily spoiled, borrowed or hauled. The Contractor shall neither borrow nor spoil any material without the Engineer's approval and without satisfying the Engineer that it is necessary and the most economical method of constructing the Works.

responsibility lies with the contractor to submit all samples to a geotechnical laboratory for control testing, and all material will be accompanied by test results prior to laying and compacting. The Engineer, shall, if necessary, submit materials to an independent geotechnical laboratory for acceptance testing, the cost of which will be paid for by the contractor.

The tendered rate shall include for crushing and process material and additives required to achieve the grading material required.

PSD 3.2 CLASSIFICATION FOR PLACEMENT PURPOSES

PSD 3.2.1 MATERIAL SUITABLE FOR EMBANKMENTS AND TERRACES

Replace the contents of this Clause with the following:

The following materials are the minimum requirements for placing in the respective fill embankments:

In engineered fill to platforms: G5 material

In engineered fill to roads: G7/G5 material

Material is not to have boulders of more than 150mm size.

PSD 5 Construction

PSD 5.1.1.2 Safeguarding of excavations

Replace Clause 5.1.1.2 (b) with the following:

The Contractor must note that the excavations for some manholes are deep and the concrete and brickwork walls to be constructed are vertical. The deep vertical faces of excavations could collapse during construction causing injury or death and the Contractor must either:-

provide a shoring system, designed by the Contractor and signed by a suitably qualified Professional Engineer,

OR

reduce the slope of excavations to the safe angle as determined by a suitably qualified Professional geotechnical engineer employed by the Contractor.

PSD 5.1.1.3 EXPLOSIVES

Add the following:

"Blasting shall not be permitted without prior written consent from the Engineer."

PSD 5.1.2 EXISTING SERVICES

BSC 557 Item 8.2

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Add the following:

“Locate, excavate by hand and redirect the sewage and stormwater or other pipeline according to engineers’ specifications.

PSD 5.1.3 Stormwater and Groundwater

Add the following to this Clause:

The Contractor shall provide, operate and maintain sufficient pumping equipment, pipes and other equipment on site as may be necessary to dispose of stormwater and groundwater for the proper execution of the Works.

For the stormwater drainage system during construction stage, the rate shall cover temporary deep holes which are to be supplied and installed on platforms to 1m below the existing ground water table and is to be placed at 300m intervals.

The rate is to include the excavation and lining of drainage channels within the platforms for deep hole to drain to which is per engineer’s specification

Add the following to this Sub-clause:

PSD 5.1.3.1 Throughout the works.

In addition to the Contractor’s responsibilities for dealing with water, the Engineer may order the Contractor to place a dump rock layer (minimum thickness 300 mm) on the platform bottom. Should the bottom conditions remain unstable due to the nature of the soil and the degree of saturation, the Engineer may order the Contractor to install a filter fabric on the bottom prior to the provision of the dump rock layer. Should the material in the bottom or the material be of such a nature that it can penetrate the dump rock layer, the Engineer may instruct the Contractor to enclose the dump layer completely within a geotextile filter blanket which shall comply with the requirements below, and shall have overlaps of at least 200 mm.

The Contractor will only be paid by providing and laying the dump layer and filter fabric after receipt of a written order to do so from the Engineer.

The cost of dealing with water as specified in Sub-clause D 5.1.2.1, as amended will be held to have been included in the tendered sums.

Dump rock in water-logged conditions:

Where the use of a layer of dump rock in the bottom has been authorized by the Engineer, it will be measured by volume calculated according to length multiplied by the minimum base width and specified thickness. The tendered rate shall cover the cost of preparation of the bottom to accommodate the layer of dump rock, the supply and placing of the layer of dump over at least the specified width and all related activities in order to produce a stable platform. The tipper tuck to load the dump rock into the placement area directly

Geotextile filter fabric:

Where the Engineer has authorised the use of geotextile filter fabric, this shall be measured by area as: width x nett length, where the width shall be the full or half-width supplied by the manufacturer which conforms closest to the specified of plus 2 x base width plus 200mm. The tendered rate shall include the cost of supply, placing and losses as a result of overlaps and over excavated trench widths.

The synthetic fibres of a geotextile blanket shall consist of at least 85% by mass of polypropylene,

polyethylene, a polyester, a polyamide, or a copolymer of vinyl chloride and vinylidene-chloride, or any combination of these polymers, and shall contain such additives as are necessary to render the filaments resistant to the effects of ultra-violet radiation and heat. The amount of water absorbed by the geotextile after 24 hours soaking in water at 20 deg. C shall be less than 1% by mass.

In addition to the requirements of Subclause 3.1.3 of SANS 1200 DK the geotextile shall comply with the following:

Mass : 150 g/m<sup>2</sup> (minimum)  
Strength in all directions : 6 kN/m (minimum)  
Equivalent opening size (EOS) : 105 micrometres (maximum)  
A non-punched, approved geotextile acceptable to the Engineer

PSD 5.1.4.1 Dust nuisance

Add the following to this Clause:

The Contractor is responsible for dust control and is liable for all claims that may result from dust nuisance on all parts of the site and surrounding areas at all times, from the date of handing over of the Site, to the completion date of the Contract.

The Contractor shall plan the Works accordingly and shall use sufficient water or other methods to keep the level of dust to a minimum. This shall be done in consultation with the Engineer and to the Engineer's approval. The contractor must make allowance for the above in the rates tendered for excavation.

PSD 5.1.4.3 Excavated material not to endanger or interfere

Add the following to this Clause:

All surplus material and unsuitable material not required for backfilling shall be disposed of at suitable sites to be located by the Contractor. All such sites shall require the approval of the Engineer and the Local Authority and community. No additional payment will be made for the transportation of such material

Dumping shall proceed in an orderly manner with coarse material placed at the bottom and covered with finer material, where possible. Upon completion of dumping, the material shall be shaped to provide free-draining surfaces and slopes and finished off to the satisfaction of the Engineer.

PSD 5.2 METHODS AND PROCEDURES

PSD 5.2.2 EXCAVATION

PSD 5.2.2.1 EXCAVATION FOR GENERAL EARTHWORKS AND FOR STRUCTURES

Add the following:

Materials under foundations and floors of structures which are regarded as unsuitable by the Engineer shall be removed to the depth and width ordered by the Engineer. Sand fill shall be placed and compacted to 100% of Max Dry Density.

Excavation of the platforms are to be according to Engineers' specifications on the drawings.

Landfill rock to be imported as drainage layer on site where specified.

(e) Where the Contractor excavates to dimensions in excess of those shown on the drawings or

ordered by the Engineer or if the material in the bottom of an excavation is loosened before concrete has been cast, or if there is any over-excavation, or any loose or disturbed soil it shall be removed and the over-excavation shall be replaced by mass concrete of prescribed mix Grade 15/20 mm.

Where blinding, mass or structural concrete is to be cast or where precast elements are to be placed on surfaces established by restricted excavation, the Contractor shall, in the case of rock surfaces, over excavate to 100 mm below the bottom of the structure and use mass concrete Grade 15/20 mm for bringing the level to the bottom of the blinding.

Excavations to final level, ready to receive a blinding layer or concrete footing, shall be completed not less than 24 hours before such layer or footing is cast.

The Contractor shall arrange for the inspection by the Engineer or his Representative of all surfaces immediately before casting concrete

#### PS D 5.2.2.3 DISPOSAL

Substitute the second sentence of D 5.2.2.3 with the following:

Suitable surplus material from excavations shall be utilised as fill material where filling is required of which the positions and levels are shown on the drawings, and should be placed, spread, shaped to the specified levels and compacted to 93% (100% for sand) of Mod AASHTO density.

Certain clay material deemed to be suitable for use at a separate dam site designated by the Engineer (Location A: Phase 1 Ngwadini dam site about 25km away), shall be stockpiled of at that site, placed in neat stockpiles. The stockpiles shall be carefully constructed and material spread and lightly compacted such that the dumpers used for transport of the material can easily use surfaces to drive on and raise the stockpile as required to dump all related material. Slopes should not exceed 1V:2H or to a stable slope as approved by the Engineer. Access to the top of the stockpile must be provided.

All surplus and unsuitable material shall be disposed of at an approved Landfill/spoil site off the site. Construction of stockpiles must be done as per paragraph above. The Contractor shall be responsible for acquiring a Landfill/spoil site for this purpose and all costs incurred, including transport to, and royalties (if applicable), shall be borne by the Contractor.

The Contractor shall inform the Engineer, in writing, at least 7 days before commencing any work which will result in a change in the topography of the site, whether such work is for the permanent works or for temporary works which the Contractor intends to execute for his own convenience. Thereupon, before commencing the work, the Contractor shall take cross-sections of the original ground profiles or another approved method to determine the ground profiles of the entire area to be worked. In addition all rock and/or foundation levels shall be recorded as the work proceeds.

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

Add the following Clauses:

#### PSD 5.2.2.4 HAND EXCAVATION AROUND EXISTING SERVICES

"Hand excavation shall be employed around existing services as required within 500mm of any

existing service.”

PSD 5.2.2.5 TEMPORARY STOCKPILING OF MATERIALS Unit : m<sup>3</sup>

“Temporary stockpiling of materials.

Where the earthwork programme earthworks pattern is such that the selected materials cannot be placed directly in their appropriate position or windrowed on positions the edges of the excavation, the Engineer may authorize their removal of such material to temporary stockpiles.

Construction materials may be temporarily stockpiled in areas as agreed by the Engineer. Stockpiling of materials within the boundaries of the site will be strictly controlled in accordance with the requirements of the EMP. All materials stockpiles or storage areas shall be kept in a neat manner and shall be controlled / protected / contained from wind or rain, so as not to cause damage to adjacent areas or to reduce visibility. On completion of the works or when an area is no longer required for stockpiling, it shall be rehabilitated to its previous state to the satisfaction of the Engineer. The cost of rehabilitation of the areas shall be deemed to be included in the Contractor's rates for site establishment. All excess spoil material shall be hauled to and disposed of at sites agreed by the Engineer and on completion of the work the sites are to be landscaped and vegetated. The tendered rate shall include full compensation for preparing stockpile areas, the constructing of haul roads, placing the material in stockpile, loading it when required, and transporting it within the free-haul boundaries, as well as for cleaning up and reinstating the stockpile areas and the obliterating of haul roads and, in the case of stockpile areas provided by the Contractor, for any charges made for the use of stockpile areas.

PSD 5.2.3. PLACING AND COMPACTION

Add the following

Backfill measured under the various items in the Schedule of Quantities shall be compacted to a density as stipulated in the scheduled item.

Material for backfilling around structures must be selected so that no clay, boulders or rock is used for backfilling within 300 mm of the structure.

PSD 5.2.3.1 EMBANKMENTS

Replace the relevant sentences with:

Material for each embankment shall be deposited in layers of thickness, before compaction, not exceeding 250mm.

G5 material shall be compacted to a minimum of 95% Max Dry Density.

G7 material shall be compacted to a minimum of 93% Max Dry Density

The areas over which earth fills are to be constructed shall, after site clearance and removal of 150mm topsoil, be ripped to a depth of 150mm and compacted to 90% of MDD. Should the topsoil layer be in excess of 150mm the Contractor is to notify the Engineer in writing and request a directive as to how to proceed further.

The Contractor shall plan his operations and particularly his cut and fill operations in such a manner that all cut material may be used to the best advantage of the Employer. This would mean that no material shall be unnecessarily spoiled.

The Contractor shall therefore not spoil any materials without the Engineer's approval and without

satisfying the Engineer that this is necessary and that the most economical method of constructing the works is proposed.

Wherever practical, fill shall be placed in successive layers parallel to the final level of the platform, in depths not exceeding 300mm unless otherwise approved by the Engineer.

Where filling is required on ground slopes greater than 1:10 or higher than 3m the Contractor shall submit proposals for benching for approval by the Engineer.

Fill in other applications shall be compacted to the densities specified in Sub-clause 5.2.3.1 of SANS1200D and Sub-clause 5.2.4.2 of SANS 1200DM (100% for sand). Material shall be placed in such a way that adjacent layers at any stage of the operation do not differ in height by more than 300mm.

**PSD 5.2.3.2 BACKFILLING OF TRENCHES AND BACKFILLING AGAINST STRUCTURES**

Add the following:

“Backfilling around structures shall be compacted to 95 % of Max Dry Density for cohesive materials, and 100 % of Max Dry density for sand, in layers not exceeding 150 mm in compacted thickness.

When specified or ordered by the Engineer the backfilling against structures shall be done with stabilised sand using a mixture of soil and cement. The mixture shall contain 5 % cement and just sufficient water for it to be placed and compacted like ordinary backfilling material.”

**PS D 5.2.5 TRANSPORT FOR EARTHWORKS**

**PS D 5.2.5.1 FREEHAUL**

Add to 5.2.5.1:

All haul of material from areas within the boundaries of the works will be regarded as freehaul.

**PS D 5.2.5.2 OVERHAUL**

Add to 5.2.5.2:

Overhaul as per this clause on this contract shall only apply to material obtained from borrow pits specified by the Employer, or spoil sites specified by the Employer, that are not known.

Where the designated borrow pits and spoil sites are known and specified, and the distance thereto known, overhaul shall not apply, and the cost for transportation shall be included in the rates for the importation or spoiling of that material. (On this contract Location A is the dam site at Phase1 approximately 25km away, for clay disposal).

Overhaul does not apply to material imported from commercial sources or borrow pits procured by the Contractor, and the cost for transportation shall be included in the rates for the importation that material.

**PSD 7 TESTING**

**PSD 7.2 TAKING AND TESTING OF SAMPLES**

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

The Contractor shall carry out sufficient process control checks (one test per five cubic metres of backfill) on the compaction of all backfill layers before calling the Engineer to inspect the work



completed. The frequency of testing shall be such that tests shall be carried out for every lift of backfill material starting from 300 mm. The costs of testing shall be deemed to be included in the rates for backfilling of the platform.

## **PSD 8 MEASUREMENT AND PAYMENT**

### **PSD 8.1 BASIC PRINCIPALS**

Add the following Sub-clauses:

#### **PSD 8.1.4 RECORDING OF ORIGINAL GROUND PROFILES**

The tendered rate for excavation shall cover the cost of recording the original ground profiles, rock and/or foundation levels, as applicable prior to commencement of any excavation, including stripping of topsoil. This is required to allow the Engineer to check the Contractor's survey and adjust his design levels if necessary.

#### **PSD 8.1.5 BACKFILLING OF OVER-EXCAVATION**

Backfilling over-excavation with concrete as specified in PSD 5.2.2.1(e), as amended, will not be measured for payment unless the over-excavation is ordered by the Engineer to remove unsuitable material, in which case the additional excavation will be measured and paid as excavation in all materials and the concrete will be measured by volume, all to the additional dimensions ordered by the Engineer.

#### **PSD 8.1.6 BENCHING**

The construction of benches shall be measured as "cut to fill" or cut to spoil as the case may be.

### **PSD 8.2 COMPUTATION OF QUANTITIES**

Add the following to Clause 8.2.1:

The volume of excavated material will be measured from the net outline of the structures and the average depth of excavation unless otherwise approved by the Engineer.

#### **PS D 8.3.2 BULK EXCAVATION**

- a) Excavate in all materials and use for embankment or backfill or dispose, as ordered ..Unit : m<sup>3</sup>

Add the following to D 8.3.2(a):

There will also be distinguished between the different types of fill and backfill as well as the different densities to which each will be compacted.

The rate for cut to spoil off-site to a site procured by the Contractor, as well as to a known sites designated by the Engineer, shall also include all costs for transporting (limited and long overhaul) as well ss Landfill fees (royalties).

#### **PSD 8.3.3 RESTRICTED EXCAVATION**

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

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

Extra-over item will be made for:

2) Material classified as “hard rock”. Refer to PSD 3.1.2, as amended.

3) Boulder excavation which, for the purposes of measurement, will be differentiated into Class A and Class B.

5) Hand Excavation Unit: m<sup>3</sup>

6) Supply, mix and place (by weight) 5 % Stabilise with CEM II A /B or CEM III A to stabilize granular material. The CEM II A /B will be measured net by volume. The rate shall cover the cost of supply, mix and placing. Unit: m<sup>3</sup>

PSD 8.3.8 EXISTING SERVICES

Add the following to this Sub-clause:

The rate shall include for the provisions specified in PSA 8.10, as amended.

PSD 8.3.11 GRASSING

Add the following to this Sub-clause:

Grass sods from the site shall be planted in all topsoiled areas or as directed by the Engineer. The rate shall include purchase of the grass, levelling of ground, fertilizing, planting, topdressing, watering, weeding and cutting the grass until an 80% coverage is achieved. Payment for grassing will be made on a pro rata basis to the coverage achieved.

PSD 8.3.14 DUMPROCK..... Unit : m<sup>3</sup>

Material requirements for fill and improved subgrade layers materials for earthworks shall be non-expansive soils or selected dump rock of sized not exceeding 200mm.

The better soil qualities shall be selected where alternative fill materials all meet the minimum material requirements. In the situation where material quantities are limited, the better-quality materials shall be used in the upper layers. Dump Rock shall in the cases where instructed by the Engineer be the preferred type of material for earthworks.

Under special conditions, such as where a near impermeable material is desirable, the Engineer may instruct that Dump Rock is to be used in the earthworks. Dumprock to be tipped and rolled to full interlock.



**PSDB EARTHWORKS (PIPE TRENCHES) (AMENDMENTS SANS 1200 DB)**

**PSDB 1 SCOPE**

Add the following:

“This specification also covers the excavation for cable trenches.”

**PSDB 2.2 APPLICATION**

Replace “pipe trenches” with “all trenches for pipes and cables”.

**PSDB 3 MATERIALS**

**PSDB 3.1 CLASSES OF EXCAVATION**

Replace the contents of this Clause with the following:

“Excavation of material for pipe trenches shall be classified as specified in PSD 3.1.”

The classification of material for excavation using labour intensive methods shall be as specified in Project Specification Clause PSD 3. For mechanical excavation the classification shall be as specified in sub-clause 3.1.2 of SANS 1200D, as amended.

**PSDB 5 CONSTRUCTION**

**PSDB 5.1 PRECAUTIONS**

**PSDB 5.1.2.2 SPECIAL WATER HAZARDS**

Save for the crossing of culverts and/or streams, where additional facilities may be required to those that could generally be required for dealing with the high ground water table and prevailing wet conditions, the cost of dealing with water as specified in PSA Clause 5.5 will be held to have been included in the tendered sums for excavation and under the relevant items in the Preliminary and General section of the Schedule of Quantities.

Where such crossings may in the opinion of the Engineer be considered as special water hazards, additional payment will be made in accordance with Payment Clause 8.3.4(b).

In addition to the Contractor's responsibilities for dealing with water, the Engineer may order the Contractor to place a crushed stone bedding layer (minimum thickness 150 mm) on the trench bottom. Should the trench bottom conditions remain unstable due to the nature of the soil and the degree of saturation, the Engineer may order the Contractor to install a filter fabric on the trench bottom prior to the provision of the stone layer. Should the material in the trench bottom or the bedding material be of such a nature that it can penetrate the stone layer, the Engineer may instruct the Contractor to enclose the stone layer completely within a geotextile filter blanket which shall comply with the requirements below, and shall have overlaps of at least 200 mm.

The Contractor will only be paid by providing and laying the stone bedding layer and filter fabric after receipt of a written order to do so from the Engineer.

The cost of dealing with water as specified in Sub-clause DB 5.1.2.1, as amended will be held to have been included in the tendered sums.

Stone bedding in water-logged conditions:

Where the use of a layer of crushed stone in the trench bottom has been authorized by the Engineer,

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it will be measured by volume calculated according to length multiplied by the minimum base width and specified thickness. The tendered rate shall cover the cost of preparation of the trench bottom to accommodate the layer of stone, the supply and placing of the layer of stone over at least the specified width and all related activities in order to produce a stable platform.

Geotextile filter fabric:

Where the Engineer has authorised the use of geotextile filter fabric, this shall be measured by area as: width x nett length, where the width shall be the full or half-width supplied by the manufacturer which conforms closest to the specified of plus 2 x base width plus 200mm. The tendered rate shall include the cost of supply, placing and losses as a result of overlaps and over excavated trench widths.

The synthetic fibres of a geotextile blanket shall consist of at least 85% by mass of polypropylene, polyethylene, a polyester, a polyamide, or a copolymer of vinyl chloride and vinylidene-chloride, or any combination of these polymers, and shall contain such additives as are necessary to render the filaments resistant to the effects of ultra-violet radiation and heat. The amount of water absorbed by the geotextile after 24 hours soaking in water at 20 deg. C shall be less than 1% by mass.

In addition to the requirements of Subclause 3.1.3 of SANS 1200 DK the geotextile shall comply with the following:

Mass : 150 g/m<sup>2</sup> (minimum)  
Strength in all directions : 6 kN/m (minimum)  
Equivalent opening size (EOS): 105 micrometres (maximum)  
A non-punched, approved geotextile acceptable to the Engineer.

**PSDB 5.5 Trench bottom**

**Add the following to this Clause:**

Where the Contractor's method of working results in quagmire conditions in the trench bottom, the Contractor shall excavate and stabilize the trench at his own cost to the approval of the Engineer.

**PSDB 5.6 BACKFILLING**

**PSDB 5.6.2 MATERIALS FOR BACKFILLING**

In areas subject to road traffic loads and under structures, etc, backfill materials shall be G7 insitu or imported fill quality compacted to 93% (100% for sands) Mod AASHTO density.

**PSDB 5.6.3 Disposal of Soft Excavation Material**

Delete the contents of Clause 5.6.3 and replace with the following:

All surplus material and unsuitable material not required for backfilling shall be disposed of at suitable sites to be located by the Contractor. All such sites shall require the approval of the Engineer and the Local Authority and community. No additional payment will be made for the transportation of such material

Dumping shall proceed in an orderly manner with coarse material placed at the bottom and covered with finer material, where possible. Upon completion of dumping the material shall be shaped to provide free-draining surfaces and slopes and finished off to the satisfaction of the Engineer.

**PSDB 5.6.6 COMPLETION OF BACKFLIING**

The total length of open trenches shall be limited to 20m ahead of the pipe laying activity. All open trenches shall be backfilled at the end of the working day and no excavations shall be left open between 5.00pm and 8 am.

**PSDB 5.7    COMPACTION**

Replace the contents of this Clause with the following:

“All trenches shall be backfilled and compacted in layers of thickness (after compaction) not exceeding 300 mm to 100% of Max Dry Density (MDD) in sand and not less than 93% of MDD in the case of cohesive materials. There will be no separate payment for compaction in road reserves as specified in SANS 1200 DB Clause 8.3.3.3.

Sand is defined as material that conforms to the following:

% passing :	4,74 mm sieve	95% min
	0,425 mm sieve	50% min
	0,075 mm sieve	10% max

Plasticity Index : Non-Plastic”

**PSDB 5.9    REINSTATEMENT OF SURFACES**

**PSDB 5.9.4    BITUMEN ROADS: SUBBASE AND BASE**

Subbase material shall be 150 mm thick G5 crushed stone or natural gravel base compacted to 95% Mod AASHTO density and basecourse material shall be 150 mm thick G4 crushed stone base compacted to 98% Mod AASHTO density.

**PSDB 5.9.5    BITUMEN ROADS; SURFACING**

Add the following:

“The minimum thickness for asphalt road surface reinstatement shall be 40mm.”

**PSDB 8    MEASUREMENT AND PAYMENT**

**DB 8.3    SCHEDULED ITEMS**

**PS DB 8.3.2    Excavation**

- PS DB 8.3.2    a) Excavate in all materials for trenches, backfill, compact and dispose of surplus material ..... Unit : m**

Add the following to D 8.3.2(a):

The depth of excavation under roads shall be measured from the final finished level.

In cases where services lay parallel to steep slopes, the depth of the excavation will be measured along the centre of the trench (on the route of the service).

The rate for excavation for subsurface drains shall cover the cost of excavation and spoil of surplus material within 1,0 km.

The rate shall also provide for the fact that the excavation width in sand will be wider than normal and that fast excavation and backfill will reduce ground water seepage.

No additional payment will be made for control of water in the excavations and thus the rate must also allow for all costs pertaining to this aspect.

DRAFT DO NOT USE

**PSDM : EARTHWORKS (ROADS, SUBGRADE) (AMENDMENTS SANS 1200 DM)**

**PSDM 3 MATERIALS**

**PSDM 3.1 CLASSIFICATION FOR EXCAVATION PURPOSES**

Add the following to DM 3.1:

All in situ pavement material shall be classified as soft material for excavation purposes.

**PSDM 3.2 CLASSIFICATION FOR PLACING PURPOSES**

**PS DM 3.2.1 Fill**

Substitute DM 3.2.1 with the following:

Fill material under roads shall be a minimum G7 standard.

**PS DM 3.2.3 Selected Layers**

Substitute DM 3.2.3 with the following:

Materials used for selected layers shall comply with the requirements of standard specification 1200 M, or as specified on the drawings for selected layers, as follows:

Upper selected under roads: To be G5 material

Lower selected under roads: To be G7/G5 material

All imported material underlying the subbase or base of the final road prism, whichever may be applicable, that does not comply with the requirements for lower selected layer or upper selected layer in the respective depth categories, shall be removed and replaced with material complying with the requirements of selected layers, all at the Contractor's expense.

**DM 4 PLANT**

**PS DM 4.2 PLANT FOR TREATMENT BELOW SELECTED LAYER**

**PS DM 4.2.1 Pneumatic-Tyred Roller**

Pneumatic-tyred rollers shall be of the self-propelled type that is equipped with smooth pneumatic-tyred wheels of the same diameter. The mass of the roller shall be at least 10 tons. All wheels must bear the same mass.

The rollers must be equipped with devices that will be able to keep the wheels wet and clean during operation.

The wheels of the roller shall be arranged in such a way that one pass with the roller will cover the whole width of the machine. The roller must be able to take a tyre pressure of 600 kPa and the minimum allowed working tyre pressure shall be 450 kPa. The maximum difference in pressure between any two wheels shall not be greater than 35 kPa.

DM 5 **CONSTRUCTION**

DM 5.2 **METHODS AND PROCEDURES**

DM 5.2.2 **Cut And Borrow**

PS DM 5.2.2.2 **Dimensions of cuts**

Substitute "subbase" in the second paragraph of DM 5.2.2.2 with "subbase or selected layer, whichever may be applicable", and

Substitute "CBR of at least 7" with "CBR as applicable according to the provisions of PS DM 3.2.3".

PS DM 5.2.2.3 **b) Cut to spoil**

Substitute DM 5.2.2.3(b) with the following:

All surplus and/or unsuitable material shall be removed from the site and disposed of at the spoil site (as described in PS D 5.2.2.3) and shall be shaped to establish a free draining surface.

DM 5.2.3 **Treatment Of Road-bed**

PS DM 5.2.3.3 **Treatment of road-bed**

- a) Preparation and compaction of road bed.

Substitute the first paragraph of DM 5.2.3.3(a) with the following:

The road-bed shall be scarified to a depth of 150 mm, watered, shaped and compacted to 93 % of Max Dry Density (100 % for sand), except where otherwise ordered by the Engineer.

In clay areas only excavation and shaping to the correct level will be necessary.

Add the following subclause:

- (c) In situ preparation of road-bed with eight roller passes.

Any part of the road-bed that lies within the selected layer and which, regardless of its density, is suitable according to the Engineers opinion, can be used in situ if so instructed by the Engineer.

If due to the nature of material, the degree of compaction cannot be controlled by means of in situ density tests, the Engineer may instruct compaction to be done by eight roller passes as specified in PS DM 4.2. The Engineer may further request that the compaction effort be altered by increasing or reducing the number of passes and that payment be amended accordingly.

PS DM 5.2.4.2(f) **Compaction of fill**

In (1) change "90%" to "93%"

PS DM 5.2.5 **Selected Layer**

Add the following to DM 5.2.5:

The compaction requirements for the various specified materials are as follows:

G5 material to minimum of 98% Max Dry Density

G7 material to minimum of 93% Max Dry Density (100% for sand)

Add the following to DM 5.2.5:

The Engineer may, depending on the quality of the in situ material, order the omission of one or both of the selected layers. To determine the amount of selected layers, if any, the Engineer may order the Contractor to dig test holes with maximum dimensions of 1,5 m x 1,5 m and 1,0 m deep at positions indicated by the Engineer, before construction commences.

The Contractor shall backfill all test holes with selected material and compact it to 95 % of Max Dry Density, after the Engineer has taken samples and profiled the holes.

**PS DM 5.2.8 Transport**

**PS DM 5.2.8.1 Freehaul**

The provisions of D 5.2.5.1 and PS D 5.2.5.1 apply.

**PS D 5.2.8.2 Overhaul**

The provisions of D 5.2.5.2 and PS D 5.2.5.2 apply.

**PS DM 5.2.9 Shaping And Compacting Below Selected Layer**

Each portion of the road-bed below the selected layer which, by virtue of its inadequate natural density, is directed by the Engineer to be compacted by means of a pneumatic-tyred roller, shall be prepared by shaping where necessary, and each such portion shall be compacted by means of at least eight complete passes by a pneumatic-tyred roller. One pass shall consist of the complete area being systematically passed in the longitudinal direction so that each pass overlaps the previous by half.

**DM 7 TESTING**

**DM 7.3 ROUTINE INSPECTION AND TESTING**

Substitute DM 7.3.2 with the following:

No density shall be less than the specified minimum density for the relevant layer.

The cost of all routine testing done by the Engineer, and of which the results do not comply with the specified minimum requirement for the material, shall be borne by the Contractor and will be subtracted from the monthly payment certificates.

**DM 8 MEASUREMENT AND PAYMENT**

**DM 8.3 SCHEDULED ITEMS**

**PS DM 8.3.3 Preparation Of Road Bed**

Substitute DM 8.3.3(b)(1) and (2) with the following:



b) Preparation of in situ road-bed in:

- |    |                       |                       |
|----|-----------------------|-----------------------|
| 1) | Intermediate material | Unit : m <sup>3</sup> |
| 2) | Hard rock material    | Unit : m <sup>3</sup> |

PS DM 8.3.4 **Cut To Fill, Borrow To Fill** ..... Unit : m<sup>3</sup>

Substitute "90 %" in DB 8.3.4 with "93% (100 % for sand)" and "road prism" with "road prism and borrow pits".

Add the following:

Separate items will be scheduled for fill in the road prism, fill on spoil areas and fill on erven (where a minimum density for such spoil material is required by the Engineer) and fill from the road prism, fill from the site and fill from commercial sources.

The rate for fill from commercial sources shall, in addition to the requirements of DM 8.3.4, cover the cost of the location of the source, complying with all the applicable precaution as set out in DM 5.1, obtaining the material, selection and transport from the source to the point on the road where it is to be used.

PS DM 8.3.5 **Selected Layer Compacted To 98 % Of Max Dry Density** ..... Unit : m<sup>3</sup>

Substitute "98 % of Max Dry Density" in the heading of DM 8.3.5 with "density as specified in PS DM 5.2.5".

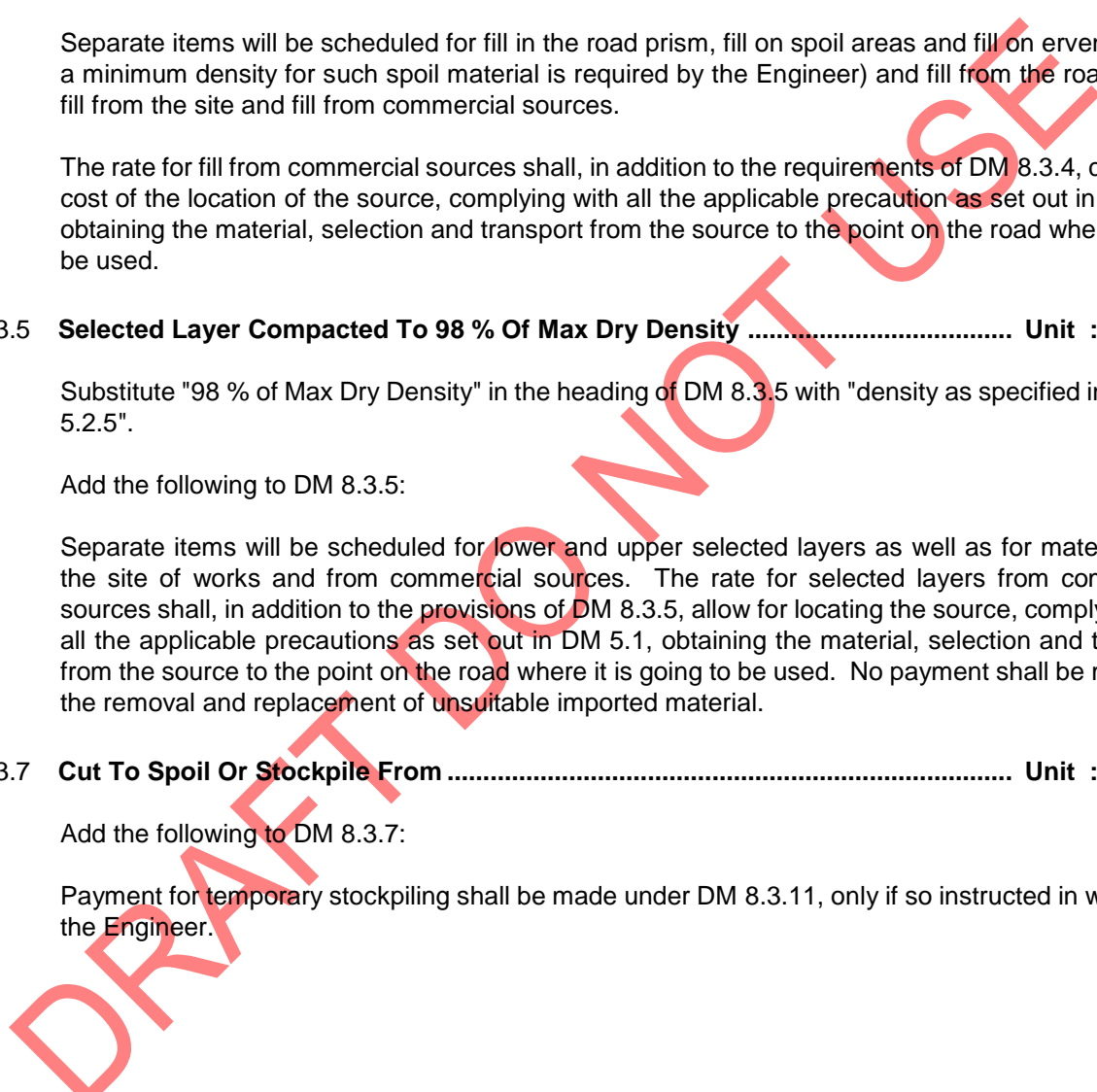
Add the following to DM 8.3.5:

Separate items will be scheduled for lower and upper selected layers as well as for material from the site of works and from commercial sources. The rate for selected layers from commercial sources shall, in addition to the provisions of DM 8.3.5, allow for locating the source, complying with all the applicable precautions as set out in DM 5.1, obtaining the material, selection and transport from the source to the point on the road where it is going to be used. No payment shall be made for the removal and replacement of unsuitable imported material.

PS DM 8.3.7 **Cut To Spoil Or Stockpile From** ..... Unit : m<sup>3</sup>

Add the following to DM 8.3.7:

Payment for temporary stockpiling shall be made under DM 8.3.11, only if so instructed in writing by the Engineer.



**PSG CONCRETE (STRUCTURAL) (AMENDMENTS SANS 1200 G)**

**1. SCOPE (CLAUSE 1)**

No amendments.

**2. INTERPRETATIONS (CLAUSE 2)**

**2.1 DEFINITIONS (SUBCLAUSE 2.3)**

**2.1.1 General (Subclause 2.3 a))**

*Add the following:*

“Construction joint:

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

extender:

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

cementitious binder:

common cement that complies with the requirements of SANS 50197-1, and blends of certain types of common cement and cement extenders that comply with the requirements of SANS 1491-1, SANS 1491-2 or SANS 1491-3

water/cement ratio:

ratio (by mass) of the water to the cementitious binder in a concrete mix.”

**2.2 EXPLANATION OF TERMS (SUBCLAUSE 2.4)**

**2.2.1 Joints (Subclause 2.4.3)**

*Add the following:*

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

**3. MATERIALS (CLAUSE 3)**

**3.1 CEMENT (SUBCLAUSE 3.2)**

**3.1.1 Alternative types of cement (Subclause 3.2.2)**

*Replace the contents of this subclause with the following:*

“Unless otherwise specified, only CEM I 52.5 or CEM I 42.5 (Portland cements), CEM II A-V42.5 or CEM II A-S 42.5 in accordance with SANS 50197-1 may be used.

Cement extenders shall only be used where specified on the drawings and scheduled in the Bill of Quantities. An approved cement extender shall only be blended with CEM I 42.5 (Portland Cement) and this shall be done in the batch plant unless otherwise approved.

Any cement extender used shall comply with SANS 1491 Parts 1, 2 or 3 as appropriate for Ground Granulated Blast-Furnace Slag (GGBS), Fly Ash (FA) or Condensed Silica Fume (CSF) respectively, and shall carry the SANS mark, or similar approved.

Where a cement extender is specified, the maximum proportion by mass of the extender as a proportion of the total mass of cementitious binder shall be as follows for different extenders unless otherwise specified:

GGBS	50%
FA	30%
CSF	15%

The test results conducted to evaluate the conformity of cement in terms of SANS 50197-1, Clause 9, shall be made available to the Engineer at least 28 days before the materials are used for concrete.'

### 3.1.2 Storage of cement (Subclause 3.2.3)

*Add the following:*

"Cementitious binder shall be used in the order in which it is received. Unless approved by the Engineer, cementitious binder kept in storage for longer than 8 weeks shall not be used in the Works.'

### 3.2 WATER (SUBCLAUSE 3.3)

*Add the following*

"Where potable water is not used as mixing water for concrete, the water shall comply with BS EN1008:2002 *Mixing Water for Concrete*."

### 3.3 AGGREGATES (SUBCLAUSE 3.4)

#### 3.3.1 Applicable Specification (Subclause 3.4.1)

*Add the following:*

"The nominal stone size specified in the concrete grade (e.g., 30 MPa/40 mm) shall mean stone conforming to the grading specified in SABS 1083 for the nearest equivalent size, i.e., 40 mm means stone that complies with SABS 1083 for 37,5 mm size.

The fineness modulus of the sand delivered to the mixer shall lie between 1,7 and 2,8 and the standard deviation of fineness moduli of samples of sand that is delivered to the mixer during one shift shall be not more than 0,10.

Notwithstanding the requirements of SANS Subclause 3.4.1, the grading of the fine aggregate (sand) and coarse aggregate (stone or pea gravel) to be used for grouting

shall conform to the gradings given in Tables 1 and 2 respectively, below.

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

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

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

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

**3.3.2 Use of plums (Subclause 3.4.2)**

*Replace the contents of this subclause with the following:*

“The use of plums will not be permitted. “

**3.4 ADMIXTURES (SUBCLAUSE 3.5)**

**3.4.1 Air-entraining agents (Subclause 3.5.2)**

*Replace the contents of this subclause with:*

“No air-entraining agents will be permitted.”

**3.5 CONCRETE USING REACTIVE AGGREGATES (NEW SUBCLAUSE 3.9)**

Reference is made to “Fulton’s Concrete Technology, Chapter 10, Alkali-silica reaction.”

In accordance with this reference, the Contractor shall provide the Engineer with sufficient data to enable him to assess the degree of alkali-aggregate reactivity of the aggregates and cement to be used for concrete. For the aggregates, the type of rock and source will inter alia be required. For the cement, the percentage alkali content shall be given.

In accordance with the above reference, where potentially reactive aggregates are used in concrete, the Contractor shall ensure that the concrete is not subject to deleterious alkali-aggregate reaction by limiting the total equivalent sodium oxide

content of the concrete to a maximum of  $0.86 \times$  the value given in  $\text{kg/m}^3$  in Table 10.1. (e.g., for Malmesbury Group,  $0.86 \times 2.1 = 1.8 \text{ kg/m}^3$ ) This may be achieved by careful mix

design and the use of cement with a low equivalent sodium oxide content or, where acceptable to the Engineer, blending with a cement extender.

For each delivery of cement the Contractor shall provide an acceptable test certificate indicating the actual equivalent sodium oxide content of the consignment.

Note 1: Potentially reactive aggregates have been identified in the following areas of South Africa: South Western Cape, Eastern Cape, KwaZulu-Natal, Gauteng and Free State.

Note 2: The equivalent sodium oxide content is measured as  $\text{Na}_2\text{O} + 0,658 \text{ K}_2\text{O}$ . For cement it is expressed as a percentage by mass, for concrete it is expressed in  $\text{kg/m}^3$ .

### 3.6 JOINT MATERIALS (NEW SUBCLAUSE 3.10)

#### 3.6.1 General

The manufacturers of the various jointing materials and methods of application shall be approved by the Engineer. Material shall be stored and protected to avoid damage, degradation, distortion or contamination.

#### 3.6.2 Fillers

Fillers shall be closed cell expanded polyethylene complying generally with the following:

- a) Where subject to hydraulic pressures (i.e., in water retaining or water excluding structures), as per Table 3.1 below:

Table 3.1

Property	Unit	Value	Test Method
Density	$\text{kg/m}^3$	110	DIN 53420
Compression Stress at compression strains of:			
10%	kPa	175	DIN 53577
25%	kPa	210	DIN 53577
50%	kPa	340	DIN 53577
Compression set after 24 hours recovery	%	14	
Tensile strength	kPa	680	DIN 53571
Elongation at break	%	49	DIN 53571
Max. water absorption after 24 hours	% Vol	0,1	ASTM C-177

- b) In structures not retaining or excluding water: Minimum density fillers of  $35 \text{ kg/m}^3$  (e.g. "Sondor Jointex").

All fillers shall be pre-cut to suit the application with a tear out strip for forming the specified recess for the bond breaker and sealant.

### 3.6.3 Bond breakers, primers and sealants

Bond breakers shall be self-adhesive PVC tape (or similar approved material) equal in width to that of the joint recess into which it is placed.

Joint sealing compounds shall comply with SANS 1220:2011 (ISO 11600:2002) and shall be impermeable ductile materials of a type suitable for the conditions of exposure in which they are placed and capable of providing a durable, flexible and watertight seal by adhesion to the concrete throughout the range of joint movement.

Primers for use with joint sealants shall be compatible with and obtained from the same manufacturers as the adjacent sealant. Primers shall have no harmful effects on concrete.

Sealants and their primers shall be resistant to ultraviolet light and biodegradation and shall be WRAS-UK certified when used in joints in water retaining or water excluding structures.

### 3.6.4 Waterstops

Waterstops shall be of approved manufacture and of the pattern and the material and widths scheduled and specified and shown on the drawings. They shall conform to Specifications CKS 388 or 389, for natural rubber or PVC respectively, and have the appropriate physical properties as set out below:

	PVC	Rubber
Tensile strength (@ 25°C)	12,2 MPa	20,5 MPa
Elongation at break (@ 25°C)	250%	450%
Hardness BS degrees (IRHD @ 25°C)	-	60 to 70°
Softness (BS)	38 to 50°	-

All intersections between waterstops shall be prepared by mitring and welding/vulcanizing intersection pieces in the factory in accordance with the manufacturer's instructions and to approval of the Engineer. Only straight lengths of waterstop may be field-welded, using the appropriate jigs and tools.

Where required, waterstops shall have eyelets so that they may be tied securely to the adjacent reinforcement. "Rearguard"-type waterstops shall have flanges or cleats that grip effectively.

## 4. PLANT (CLAUSE 4)

### 4.1 MIXING PLANT (SUBCLAUSE 4.3)

#### 4.1.1 General requirements for mixing plant (Subclause 4.3.1)

*Add the following:*

"Standby mixers of adequate capacity and with an independent power unit shall be maintained on the site for immediate use in the event of breakdown of the regular mixers or failure of the power supply."

## 4.2 FORMWORK (SUBCLAUSE 4.5)

### 4.2.1 Design (Subclause 4.5.1)

*Add the following:*

“All external angles in concrete work shall have 20 mm x 20 mm chamfers unless otherwise specified or ordered, with only the following exceptions:

- a) The top edge of a slab that is to receive an applied finish, or
- b) The top edge of a slab or wall to which banded grating walkways are to be fixed.”

### 4.2.2 Ties (Subclause 4.5.3)

*Add the following:*

“The use of sleeves for formwork ties through the walls of water retaining structures will not be permitted. Ties, when cast in, shall have some form of positive anchorage to prevent any rotation when loosening formwork. The minimum cover over tie ends shall be 40 mm. The tie plug holes shall be grouted up with an approved non-shrink grout.” Scabbling of existing concrete surface to expose aggregates and remove dust and laitance prior to grouting.

For Watertight concrete structures the shutters shall be fastened using an approved imbedded fastening system. Open ferrules will not be permitted in the reservoir.

## 4.3 WATER-BATH (NEW SUBCLAUSE 4.6)

A temperature-controlled water-bath with a capacity to cure two hundred cubes shall be provided and maintained on site. The water-bath shall be located under cover.

## 4.4 Vibrators (SUBCLAUSE 4.4)

*Add the following:*

Stand-by vibrators of adequate capacity and with an independent power unit shall be maintained on site for immediate use in the event of breakdown of the regular vibrator failure of the power supply.

Vibrators for in-situ concrete shall be of the internal or immersion type.

## 5. CONSTRUCTION (CLAUSE 5)

### 5.1 REINFORCEMENT (SUBCLAUSE 5.1)

#### 5.1.1 Fixing (Subclause 5.1.2)

*Add the following:*

“Fixing of reinforcing bars by welding will not be permitted without the prior approval of the Engineer. Where welding is approved the methods used shall be subject to the Engineer's approval. Where called for, samples of the typical reinforcement to be welded will be sent to a laboratory, designated by the Engineer, for testing purposes. Under these circumstances the welding of the samples shall be carried out on the Site



by the welder to be subsequently employed on the job and carried out under the conditions which will prevail during the actual site welding. Where welding is permitted by the Engineer, it shall be carried out in strict accordance with the relevant SABS Codes of Practice.”

### 5.1.2 Cover (Subclause 5.1.3)

*In SANS Subclause 5.1.3(a) amend the words “.. or stirrup” to read: “bar, secondary reinforcement, tie, stirrup, tying-wire knots or wire ends”.*

*Add to SANS Subclause 5.1.3: “Tying wire may not encroach on the specified minimum cover by more than a single strand thickness”.*

*Add the following:*

“Except that only mortar block spacers may be used in water retaining structures, spacers of approved design include approved plastic or other proprietary spacers, or purpose made precast mortar blocks.

Where mortar blocks are used, they shall be properly shaped so as not to slip out of position and shall be made of the same mix as the mortar of the concrete in which they are to be placed. The mortar shall be well compacted by approved means into the moulds to result in blocks with a density of at least 2 300 kg/m<sup>3</sup> and which are free from honeycombing. They shall be cured in water for at least 7 days. The wire ties in the blocks shall be galvanized. Mortar blocks which have not been manufactured and cured strictly in accordance with these requirements or which are in any other way considered unsatisfactory by the Engineer, will be rejected and shall be removed from the Site.”

## 5.2 FORMWORK (SUBCLAUSE 5.2)

### 5.2.1 Classification of finishes (Subclause 5.2.1)

*Add the following:*

“Formwork for formed concrete surfaces against which backfill will be placed shall be rough. Formwork for all other formed surfaces shall be smooth, except where otherwise specified.”

*In SANS Subclause 5.2.1(b) amend the words “.. to Degree of Accuracy II as defined in terms of Clause 6” to read: “to the Degree of Accuracy specified in Subclause 6.1.1 below”.*

*Add the following new subclauses:*

“5.2.1(d) Special smooth, repaired and rubbed finish

A surface finish achieved by using good quality, unblemished and regularly sized steel forms. The surface shall be as for a smooth finish but completely rubbed or treated to form a smooth finish of uniform texture, appearance and colour. Degree of Accuracy I shall apply to the finished surface.

5.2.1(e) Special off-form finish

A surface finish that is such that no after-treatment other than the treatment of bolt-holes (which shall be placed with regularity and precision) is required. The forms used

shall be unblemished and the panels regular. Joints are a feature of the pattern and shall be handled with care. The finished concrete shall be accurate to Degree of Accuracy I.”

5.2.1(f) Special Tooled Finish

Tooled finishes may be obtained by the use of bush-hammers, light mechanical chisels or other approved tools, preferably mechanically operated. No tooling shall be done until the concrete has attained an age of at least 14 days after casting where normal Portland cement has been used, and 5 days when rapid hardening cement has been used. It may be necessary for these periods to be extended to ensure that aggregate particles are not dislodged. The final finish shall show a surface of evenly distributed aggregate particles in slight relief. After the tooling has been completed, the surface so treated shall be scrubbed down with a stiff brush and washed with water.

**5.3 CONCRETE (SUBCLAUSE 5.5)**

**5.3.1 Quality (Subclause 5.5.1)**

*Add the following to Subclause 5.5.1.1:*

“The concrete mix design for strength concrete must be prepared in an approved laboratory and the results of actual test mixes must be submitted for approval together with 7-day and 28-day strength test results. Special attention is drawn to the fact that the concrete mix must provide a very dense and impervious concrete.

No concrete shall be cast until the mix designs have been approved by the Engineer. The Engineer may call for revised mix designs at any stage during the Contract.

In order to facilitate increasing the workability of concrete in the fresh/plastic state, to ensure watertightness without increasing the water/cement ratio, the Engineer may approve the use of an additive.

*Add the following to Subclause 5.5.1.4:*

“With reference to Table 4, efflorescence will not be acceptable on any exposed concrete surface.”

*Add the following to Subclause 5.5.1.5:*

“The following exposure condition classification applies to the concrete elements on this project:

Table 5.1

Structural Concrete Elements	Exposure condition
Concrete within the envelope of buildings and exposed to a controlled atmosphere	Moderate
All concrete for the clear well/chlorine contact tank beneath the filters, including the slabs above the clear well/chlorine contact tank	Very severe

All other concrete including: Concrete in contact with the ground or groundwater; concrete in water-retaining or water-excluding structures; concrete exposed to the elements.	Severe
---	--------

All concrete for severe exposure conditions shall have a water/cement ratio not exceeding 0,50 and a cementitious binder content of not less than 340 kg/m<sup>3</sup> of concrete. The proportions of the various aggregates shall be such as to produce a concrete density of at least 2 400 kg/m<sup>3</sup>.

All concrete for moderate exposure conditions shall have a minimum cementitious binder content of 280 kg/m<sup>3</sup> of concrete.”

*Add the following to Subclause 5.5.1.7:*

“With the exception of mixes weaker than 15 MPa, all concrete for the Works shall be considered to be strength concrete in terms of SANS Subclause 5.5.1.7.

The grade of strength concrete and if required the associated cement extender, will be specified on the Drawings or Bill of Quantities by a compound code of the form:

A/B C (e.g. 30MPa/19mm F30), where:

A = the 28 day characteristic strength (MPa)

B = the nominal maximum aggregate size e.g. 19 mm

C = the cement extender as a % of total cementitious material, for example:

F30 = 30% of Fly Ash (FA)

C15 = 15% of Condensed Silica Fume (CSF)

G50 = 50% of Ground Granulated Blast-furnace Slag (GGBS)

The maximum cement content of CEM I 42.5 shall be 400 kg/m<sup>3</sup> of concrete. The maximum cementitious binder content for concrete containing an extender shall be 460 kg/m<sup>3</sup> of concrete.”

**5.3.2 Durability (Subclause 5.5.1.5)**

*Delete Clause 5.5.1.5 in its entirety and replace with:*

The exposure conditions shall be considered as being "severe" for all grades of concrete placed on the site excluding blinding and no-fines concrete. All concretes are required to achieve the minimum requirements in the durability class "Good" as set out in Table 1 below:

Table 1: Suggested ranges for durability classification using index values

Durability Class	OPI (log scale)	Sorptivity (mm/dh)	Chloride conductivity (mS/cm)
Excellent	> 10	< 6	< 0175
Good	9.5 - 10	6 - 10	0.75 – 1.50

Poor	9.0 – 9.5	10-15	1.50 – 2.50
Very poor	< 9.0	> 15	> 2,50

**5.3.3 Prescribed Mix Concrete (5.5.1.6)**

**5.3.4 Strength Concrete (5.5.1.7)**

*Delete Clause 5.5.1.7 in its entirety and replace with:*

"The Contractor shall employ the services of an Accredited materials laboratory with the relevant concrete technology experience for the design of strength concrete mixes. The following shall be taken into account:

- (a) The intent of the mix design is to ensure for every part of the structure homogeneous concrete which will have the required strength and durability to suit the exposure conditions specified in clause PSG 5.5.1.5.
- (b) All materials shall conform to their relevant specifications
- (c) Compaction by vibration
- (d) Mass batching
- (e) Slump not exceeding the requirements as stated in Table 3 of SABS 1200 G
- (f) Available cementitious materials shall be selected to provide the best durability and strength performance
- (g) A crystalline water-proofing additive be used for reasons of durability and imperviousness
- (h) All concrete should be designed using statistical calculated margins to achieve the specified design strengths (15MPa, 20MPa, 30MPa and 35MPa) as well as the durability performance specifications in PSG 5.5.1 .5
- (i) All mix designs are to be submitted for approval in a D2 format.

**5.3.5 Batching (Subclause 5.5.2)**

"Batching of strength concrete shall be by mass. Prescribed concrete may be batched by volume."

**5.3.6 Mixing (Subclause 5.5.3)**

*Add the following to Subclause 5.5.3.2:*

"Concrete from a central concrete production facility other than on the construction site will be permitted and, apart from test results in terms of SANS Subclauses 7.3.1, 7.3.2 and/or 7.3.3, test results obtained by such a production facility as part of its quality control system will be accepted for evaluation in terms of SANS Subclause 7.3.4, provided they are stored and cured on Site. All ready mix concrete needs to conform to SANS 878."

**5.3.7 Placing (Subclause 5.5.5)**

*Add the following New Subclause 5.5.5.10:*

"Structural concrete shall not be cast directly against the side of any excavation

without the use of formwork unless prior approval has been obtained in writing from the Engineer. Otherwise **sulphate resistant** concrete shall be used in this instance where no formwork is used after having obtained approval in writing from the Engineer.

Concrete used in pipe trenches for encasement may be cast directly against the side of the excavation. Concrete for thrust/anchor blocks shall be cast directly against the side of the excavation."

#### 5.3.8 **Dropping Concrete Freely (Subclause 5.5.5.5)**

*Replace with:*

"Dropping concrete freely will only be permitted if the Engineer is satisfied that this is the only practical method of placing."

#### 5.3.9 **Blinding Layer**

*Add the following New Subclause 5.5.5.11:*

For closed circuits such as circular or rectangular water retaining structures for which no vertical joints have been detailed on the drawings, work shall commence at one or more points in the circuit and proceed in opposite directions at the same time so that on completion of the circuit the junction or junctions are formed with freshly placed concrete. The height of the lift shall be carefully pre-planned so that the concrete can be placed in one continuous operation over the entire perimeter of the wall. No unauthorised vertical or inclined construction joints of any kind will be permitted in continuous pours."

*Add the following New Subclause 5.5.5.12:*

"Beneath all structural grades of concrete or elsewhere, if so ordered by the Engineer, or shown on drawings, the bottom of the excavation is to be covered by a blinding layer (screed) in Grade 15/19 concrete to a depth of 75 mm to prevent disturbance of the ground and to serve as an even and accurate positioned working floor for setting steel and placing foundation concrete. This blinding layer shall be laid immediately after excavations have been taken out and trimmed to the required depths and have been inspected and approved by the Engineer."

#### 5.3.10 **Compaction (Subclause 5.5.6)**

*Add the following New Subclause 5.5.6.5:*

"The tops of all walls and columns shall be re-vibrated within 3 hours of the concrete having been placed"

#### 5.3.11 **Construction joints (Subclause 5.5.7)**

*Add the following:*

"The edge of joints, exposed to view in the finished structure, shall be formed with suitable beads to provide a straight edge true to line and level."

All joints, other than expansion, contraction and other movement joints, shall be treated as follows:

As soon as practical, but not before 15 hours after placing, the construction joint surface shall be prepared to receive fresh concrete. This preparation, as specified in 5.5.7.3(a) to (d), shall be such as to remove all laitance or inert and strengthless material which may have formed and the specified chipping or sand blasting shall be such as to produce a roughened surface all over.

When concreting is interrupted concrete surfaces shall be protected from the sun as specified in SANS Subclause 5.5.8(d) or by means of hessian kept damp until concreting is resumed.

All constructional joints (as defined in Clause 2.1), both designated and non-designated (as explained in Clause 2.2.1) (i.e. all joints other than movement, contraction and expansion joints), shall be dealt with as specified in SANS Subclause 5.5.7.3.

All positions of construction joints other than designated joints shown on the drawings shall be submitted to the Engineer for approval prior to construction."

*Add the following the new Subclause 5.5.7.4:*

"Formed joints will be considered to be designated joints as defined in SANS Subclause 2.4.3. (The forming of a straight edge to a construction joint as specified in Clause 5.3.5 above does not constitute a formed joint).

Each joint shall be formed as shown on the drawings, complete with shear key rebates, waffle formwork, V-feature, waterstops, "Flexcell" or equal, approved joint filler, dowel bars and their PVC tubes, etc. as indicated."

*Add the following new Subclause 5.5.7.5:*

"Any non-designated joints shall be identical to designated joints, as shown on the drawings, which would be used in similar positions and perform the same function."

*Add the following new Subclause 5.5.7.6:*

"Construction joints between foundations, footings or floors and walls, columns or piers connected to them, shall not be made flush with the supporting surface, but shall be made a minimum of 75 mm above the footing or floor unless shown otherwise on the drawings or approved by the Engineer. The "kicker" shall be cast as an integral part of the foundation, footing or floor."

*Add the following new Subclause 5.5.7.7:*

"The concrete to which the primer or adhesive is to be applied shall be dry and shall be cleaned of all dust, grit, grease, surface laitance and foreign matter by compressed air and/or water, solvents, or other suitable approved means. The Contractor shall provide on Site an approved moisture meter to measure the degree of dryness of the joint. This meter shall be made available to the Engineer for testing. The joint shall be approved for the application of the primer and adhesive if the moisture content of the concrete is less than or equal to 5%. It may be necessary to dry the concrete surfaces locally by means of a gas torch or other approved manner."

*Add the following new Subclause 5.5.7.8:*

"Contraction and expansion joints shall be formed true to line in smooth formwork.

Contraction and expansion joint surfaces shall be thoroughly cleaned of all accretions



of concrete or other foreign matter by scraping or other approved means.

Particular care shall be taken to compact the concrete around waterstops, edges, etc., using adequate approved tools and experienced, reliable workmen.

Rebates for seals shall be formed to required dimensions and lines or cut true to line and size by skilled workmen with special tools, after floating the surface and before the final set of the cement has taken place. All rebates, etc., shall be adequately protected against damage until the completion of the work; accidental damage which in the opinion of the Engineer will impair the performance or appearance of the joint, shall be made good by reconstructing the work as directed by the Engineer. Rebates for seals shall be grit blasted or wire brushed on all faces to remove surface laitance and thoroughly cleaned with soft brushes and/or compressed air jets, and, if necessary, dried by blow-lamp or other approved means before priming.”

*Add the following new Subclause 5.5.7.9:*

“Waterstops shall be held in the formwork so as to prevent air pockets forming underneath them. Special precautions shall be taken to the approval of the Engineer, to ensure that all flexible waterstops are in perfect contact with well compacted void-free concrete. The Contractor shall provide satisfactory supervision of such vital operations.

All waterstops shall be supplied in lengths as long as practical in order to reduce site butt-welding to a minimum (noting still the requirements of Subclause 3.6.4 above).

Waterstops in all joints within a structure forming a water-retaining barrier shall be continuous throughout all intersections, junctions and corners within that barrier.

Waterstop junction pieces shall be standard factory-produced items wherever possible. Where standard items are not manufactured, junctions shall be purpose made in the factory. On-site making-up of intersection-pieces will not be permitted; only straight welded butt-joints may be made on site.

Prior to use, all waterstops shall be carefully stored and handled to avoid damage or contamination by oil, grease, etc. Waterstops shall be stored in a cool, well-ventilated place, away from the sunlight. Nails shall not be driven into waterstops, except where specifically catered for the design of the waterstops.”

*Add the following new Subclause 5.5.7.10:*

“Joints in the filler shall be neatly butted so as to exclude mortar from the joint. Edges of filler strip against waterstops, concrete, formwork, projections, etc., shall also be closely fitted to exclude mortar, so that there is no resistance (other than the compression of the filler) to the expansion movement for which the joint is designed.

Joint filler shall be fixed to the first cast of concrete with an approved adhesive and as directed by the Engineer.”

*Add the following new Subclause 5.5.7.11:*

“Rebates shall be cleaned as required by new SANS Subclause 5.5.7.6 in Clause 5.3.5 above and shall be inspected and approved by the Engineer's Representative before filling.

Joint sealants and primers shall be applied strictly in accordance with the manufacturer's instructions. Flow and non-slumping grades shall be used for horizontal and vertical joints respectively.



Only skilled workmen, experienced in this type of work shall be employed to apply the sealant.

Immediately after the compound is applied the joint shall be protected against damage until completion of the Contract."

### 5.3.12 **Curing and protection (Subclause 5.5.8)**

*Add the following new Subclause 5.5.8.1:*

"Horizontal and near horizontal surfaces shall be treated in accordance with SANS Subclause 5.5.8.

Other surfaces of the concrete shall be treated with a curing compound complying with new Subclause 5.5.8.3 below."

*Add the following new Subclause 5.5.8.2:*

"In order to improve the effectiveness of the curing treatment, the specified minimum stripping time for removal of formwork shall be the greater of 4 days and the value in Table 2 of Sub-clause 5.2.5.2. After the removal of the shutters, further curing method shall apply in accordance with Sub-clause 5.5.8 and the new Sub-clause 5.5.8.3."

*Add the following new Subclause 5.5.8.3:*

"The use of membrane curing compounds will be allowed on vertical faces or steeply inclined faces (i.e. steeper than 45° to the horizontal) of cast in situ members of the structures subject to the Contractor producing sufficient, satisfactory cube crushing strength test results where the crushing strength of cubes which have been cured with the proposed curing membrane and left exposed to the elements are compared with those of an equal number of water cured cubes. The crushing strength of cubes cured with the proposed membrane shall be at least 85% of the crushing strength of the water cured cubes.

Before any membrane curing compound is used, each batch shall be tested on a trial surface to ensure that it forms a satisfactory membrane, and any compound which is unsatisfactory in the opinion of the Engineer, shall be rejected. Curing membranes will be disallowed if permanent discolouration of the concrete takes place. Surfaces where curing membranes are used shall be treated in such a manner that the final concrete texture and colour blends in with the rest of the concrete work. Furthermore, the Engineer shall, at his discretion, require the Contractor immediately to adopt an effective alternative means of curing any area of the structure to which a membrane has been applied which, in the opinion of the Engineer, is unsatisfactory. The curing compound used shall be to the approval of the Engineer. Wax based curing compounds will not be permitted.

The curing compound shall be applied immediately as formwork is progressively stripped or, in the case of unformed surfaces, when the concrete has taken its initial set. It shall preferably be applied by spraying and the rate of application shall be strictly in accordance with the manufacturer's recommendations. A method of monitoring the area to which curing compound has been applied and the application rate shall be as approved by the Engineer and rigidly applied by the Contractor.

Surfaces of joint rebates, where elastomeric sealant is to be applied, shall be protected from contamination by curing compound by the use of masking tape."

### 5.3.13 Adverse weather conditions (Subclause 5.5.9)

*Add the following to Subclause 5.5.9.2:*

“If concrete is to be cast during times of high ambient temperature or hot drying winds, the Contractor shall be responsible for taking the necessary steps to keep the placement temperature as low as possible. Such steps include the spraying of the coarse aggregate with water, the painting of silos with reflecting aluminium paint, the insulation of tanks and pipelines, and the protection of concrete ingredients against the direct rays of the sun. The area of the pour shall be shaded before and during concreting and the concrete shall be shaded from the time of mixing until eight hours after placing.

Windbreaks shall be erected if necessary.”

*Add the following new Subclause 5.5.9.4:*

“The Contractor shall take whatever measures are necessary to prevent plastic shrinkage cracks in the concrete. Particularly on dry windy days or hot sunny days, the Contractor shall make provision for fine spraying of the concrete surface with water within one hour of casting or covering of the concrete with black plastic sheeting. It may be necessary to change the aggregates of the concrete mix proportions.

If plastic shrinkage cracking occurs, the cracks shall be closed up by re-vibrating the concrete with a poker vibrator, within about three hours of casting. Once the cracks have been closed, the concrete shall be kept thoroughly wet, or covered with plastic sheeting for at least a further three hours.”

### 5.3.14 Concrete surfaces (Subclause 5.5.10)

*Add the following to Subclause 5.5.10.1:*

“After placing and compacting, the concrete on an exposed (unformed) surface shall be struck off with a template to the designated grades and tamped with a tamping board to compact the surface thoroughly and to bring mortar to the surface, leaving the surface slightly ridged but generally at the required elevation. No mortar shall be added, and noticeable surface irregularities caused by the displacement of coarse aggregate shall be made good by re-screeding after the interfering aggregate has been removed or tamped.”

*Add the following to Subclause 5.5.10.2:*

#### “Wood-floating

Where wood-floating is ordered or scheduled, the surface shall first be given a finish as specified in new SANS Subclause 5.5.10.1 and, after the concrete has hardened sufficiently, it shall be wood-floated, either by hand or machine, only sufficiently to produce a uniform surface free from screeding marks.

#### Steel-floating

Where steel-floating is specified or scheduled, the surface shall be treated as specified in new SANS Subclause 5.5.10.1 except that, when the moisture film has disappeared and the concrete has hardened sufficiently to prevent laitance from

being worked to the surface, the screeded surface shall be steel-trowelled under firm pressure to produce a dense, smooth, uniform surface free from trowel marks.

#### **Power-floating**

Where power-floating is specified or scheduled, the surface shall be treated as for wood-float finish, except that the screed surface shall be power floated to produce a high quality dense, smooth uniform surface free from trowel marks.

#### **Screeding**

Where special/proprietary screeding or granolithic screeding is specified or scheduled, the surface shall be treated as specified in new SANS Subclause 5.5.10.1 before application of the screed.

Granolithic screed shall consist of:

Cement	1 part by mass
Sand	1,25 parts by mass
Coarse aggregate	2 parts by mass

The coarse aggregate shall consist of granite or other approved chips which shall pass a 10 mm sieve and be retained on a 5 mm sieve.

The water/cement ratio of the mix shall be 0,5 or less.

Before placing any granolithic screeds, the base concrete shall be chipped to expose the aggregate over 100% of the area to be screeded and soaked with water for at least 24 hours.

The base concrete shall be thoroughly cleaned by scrubbing and all standing water removed after soaking. A 1:2 cement/sand grout shall then be brushed into the prepared surface followed by the granolithic screed before the grout sets. The granolithic screed shall be of the driest feasible consistency with a slump not exceeding 50 mm and shall be formed true to profile and shape as required and shown on drawings. Before placing granolithic screed against an adjacent band of granolithic screed, the edge of the latter shall be prepared by chipping back to firm material, wire brushing and brushing with grout as for the base concrete.

Granolithic screed shall be compacted to remove all air and shall be screeded and finished with a steel trowel to Degree of Accuracy 1.

The troweling shall be carried out in the following stages: -

- 5.3.14.1 First - as soon as the granolithic screed has been compacted and screeded.
- 5.3.14.2 Second - after 2 hours to close the surface and remove laitance.
- 5.3.14.3 Third - after a further 4 hours.

The time intervals are estimated as appropriate to normal temperature conditions and shall be varied by the Contractor to ensure a smooth dense finish.

Granolithic screed shall be cured as specified in SANS Subclause 5-5.8(b) but shall additionally be protected from direct sunlight and drying winds as it is being placed.

All screeding necessary to accommodate equipment provided by the Mechanical and Electrical Contractor shall be done under that contractor's supervision and in strict accordance with his instructions. It shall be commenced as soon as the equipment supplier gives notice on completion of erection and shall be finished expeditiously.

The Contractor shall make good any damage to the equipment resulting from his personnel not following the Mechanical and Electrical Contractor's instructions. Any spillage on the equipment shall be cleaned off immediately."

### **Tolerances**

#### **5.3.15 Watertight concrete (Subclause 5.5.11)**

*Add the following:*

"The following structures and components of structures shall be considered watertight concrete structures and SANS Subclause 5.5.11 shall apply:

- 5.3.15.1 All reinforced concrete basement floors, walls suspended slabs and roofs of all water retaining structures and vessels
- 5.3.15.2 The reinforced concrete roofs of all building other than water retaining structures
- 5.3.15.3 All reinforced concrete retaining walls."

#### **5.3.16 Pipes and Conduits Embedded in Concrete**

*Add the following to Subclause 5.5.11.1:*

"Except with the written approval of the Engineer, no pipes other than those shown on the drawings shall be embedded in concrete and the approval of the Engineer for the position of all services to be embedded shall be obtained before concreting commences. The clear space between pipes of any kind embedded in reinforced concrete and the clear space between such pipes and reinforcement shall not at any point be less than:

- (a) 40 mm or
- (b) 5 mm plus the maximum size of coarse aggregate, whichever is the greater. PSG 5.5.11.2 Grouting of Pipes and Specials Through Walls:

Where entry holes for pipes/specials have been provided in walls the Contractor shall be responsible for the grouting-in of such pipes/specials, regardless of whether or not these have been supplied by himself.

Before commencing the positioning in holes of any pipes/specials the Contractor shall:

- (a) Remove all shuttering and boxing remaining in the holes
- (b) Make any alterations required to the position and shape of the holes
- (c) Thoroughly scrub and clean the sides of the holes so as to obtain a satisfactory bond surface for the concrete
- (d) Free all surfaces of the pipes/specials of all coatings, and thoroughly scrape and clean the Pipes/specials

After accurately positioning the pipes/specials in their respective holes, the Contractor shall fix the pipes/specials in the holes.

Immediately before grouting is carried out by the placing of mortar and concrete around the pipes, the surface of the existing concrete shall be saturated with water.

All surplus water shall be removed, and the surface covered with a layer, approximately 12 mm thick, of mortar consisting of 3 parts of concrete sand and 1 part of cement.

The concrete ingredients shall be mixed and placed as dry as possible to obtain a dense, waterproof concrete. Where a watertight seal is required, the concrete shall be carefully worked around the puddle flange, if any, and the pipe barrel or body of the special, and shall be vibrated in layers to obviate any falling away from pipe/special surfaces of the concrete already placed. The hole shall, when set, form a dense, homogeneous, and waterproof mass. A spare vibrator with an independent power source shall be kept in readiness to ensure continuity of placing in the event of the breakdown of the duty vibrator.

Smooth formwork that has been suitably strengthened for use with a vibrator shall be provided for facing the concrete around each pipe/special.”

#### **5.3.16 Grouting (Subclause 5.5.13)**

*Add the following:*

“Unless otherwise approved by the Engineer, proprietary grouting materials shall be obtained ready-mixed in sealed pockets as supplied by the manufacturers.”

#### **5.3.17 Defects (Subclause 5.5.14)**

*Add to the end of Subclause 5.5.14.1:*

“All defects shall be repaired as soon as possible after the formwork has been removed and the Engineer has inspected the concrete. A statement of the method to be used for each repair shall be submitted to the Engineer for his approval before any work is carried out. The Engineer may prohibit the further placing of concrete in the particular area concerned until he is satisfied that the repair has been satisfactorily executed.”

#### **5.3.18 Casting pipes and specials in concrete (New Subclause 5.5.16)**

Where a pipe or special is to be cast in later such as for items supplied by others, the Contractor shall provide a box-out in the wall and cast the unit in at a later stage. When constructing such box-outs, reinforcement bars shall not be cut but shall run through the opening. The reinforcement shall then be cut and/or bent out at a later stage to suit the item being cast in. After positioning of the item, the remaining reinforcement shall be bent back in position (i.e. after flanges or similar protruding components have been passed through the reinforcing).

Before commencing the positioning in holes of any pipes/specials the Contractor shall:

5.3.18.1 remove all formwork and boxing remaining in the holes;

5.3.18.2 make any alterations required to the position and shape of the holes and cut/bend reinforcement to suit the item (keeping cutting to an absolute minimum), as directed by the Engineer; and

5.3.18.3 thoroughly scabble the sides of the holes so as to obtain a satisfactory bond surface for the new concrete and treat the surface as specified in SANS Subclause 5.5.7.3.

Immediately prior to concreting being carried out by the placing of mortar and concrete around the pipes, the surface of the existing concrete shall be saturated with water. All surplus water shall be removed, and the surface covered with a layer, approximately 12 mm thick, of mortar made of the same mix as the concrete in which the pipes/specials are to be placed.

The concrete ingredients shall be mixed and placed as dry as possible to obtain a dense, waterproof concrete. The concrete shall be carefully worked around the puddle flange, if any, and the pipe barrel or body of the special, and shall be vibrated in layers so as to obviate a falling away from pipe/special surfaces of the concrete already placed. The whole shall, when set, form a dense, homogeneous, and waterproof mass.

### 5.3.19 "No-fines" concrete (New Subclause 5.5.17)

A nominal aggregate size of 19 mm shall be used in the manufacture of "no-fines" concrete. The concrete shall be mixed in the following proportions:

Cement	:	50 kg
Aggregate	:	0,40 m <sup>3</sup>
Water	:	22,5 ℓ

Between 24 h and 48 h after the no fines layer has been laid it shall be covered with a 1:4 cement:sand mortar skim layer 20 mm thick. The mix shall be comparatively dry to ensure that it does not penetrate and block the cavities in the no fines concrete. The surface shall be steel floated to form a plane surface.

The mortar skim shall be cured in the same manner as concrete for a period of not less than 2 days.

### 5.3.20 Precast paving slabs (New Subclause 5.5.18)

The paving slabs shall comply with the requirements of SANS 541, shall be as scheduled and with patterned surface, or equal approved. Samples of the types which the Contractor proposes to use shall be submitted for approval prior to construction.

The area to be paved shall be compacted to 95% of MAMDD, trimmed and then treated with an approved weedkiller, with care being taken to avoid contaminating surrounding areas. The paving slabs shall be laid on a sand bed approximately 25 mm thick, which shall be graded to the required levels and slopes as approved by the Engineer.

The joints between the slabs shall be 2 mm to 6 mm wide and shall be grouted with cement mortar. Gaps in the pattern of slabs shall be filled with Grade 15 MPa/20 mm concrete and given a wood floated finish.

### 5.3.21 Grouting in of equipment (New Subclause 5.5.19)

5.3.21.1 The Contractor shall form pockets to the details shown on the drawings to accommodate holding down bolts for equipment provided by the Contractor or by



the Mechanical and Electrical Contractor. The holding down bolts will be provided and positioned by the Mechanical and Electrical Contractor for his equipment.

5.3.21.2 After casting of the concrete all shuttering shall be removed and the inside of the bolt holes and the surface on which any machine base is to be placed shall be cleaned and scabbled to remove all defective concrete, laitance, dirt, oil, grease and loose material.

5.3.21.3 Upon completion of the positioning and alignment of equipment (the Mechanical and Electrical Contractor will position his own equipment), and when instructed by the Engineer, the Contractor shall in collaboration with the Mechanical and Electrical Contractor, grout up pockets and baseplates by filling pockets and voids under the baseplates with an approved non-shrink grout.

### **5.3.22 Backfilling of excess excavations (New Subclause 5.5.20)**

Wherever the Contractor has over-excavated below the specified founding levels, such over-excavation shall be backfilled to bring the founding surface to the correct level by placing and compacting either no-fines concrete or mass concrete of Grade 15 MPa/19 mm as directed by the Engineer.

## **6 TOLERANCES (CLAUSE 6)**

### **6.3 PERMISSIBLE DEVIATIONS (SUBCLAUSE 6.2)**

#### **6.3.5 Specified permissible deviations (Subclause 6.2.3)**

*Add the following:*

“Degree of Accuracy I shall apply to the following structures/components of the Works, as well as further accuracy requirements where so stated:

6.3.5.1 The interior of all water retaining structures

6.3.5.2 All Precast Units

6.3.5.3 Spacing between two adjacent bars  $\pm 5\text{mm}$

Degree of Accuracy II shall apply to all other structures/components of the Works, unless specified otherwise or otherwise noted on the drawings.”

## **7 TESTS (CLAUSE 7)**

### **7.3 FACILITIES AND FREQUENCY OF SAMPLING (SUBCLAUSE 7.1)**

#### **7.3.5 Frequency of sampling (Subclause 7.1.2)**

*Add the following to Subclause 7.1.2.1:*

“One sample shall consist of three concrete test cubes.

For each sample taken the position in the structure shall be recorded where the batch represented by that sample is placed.”

*Amend Subclause 7.1.2.2 to read as follows:*

“At least one sample (of 3 concrete test cubes) shall be taken from each day’s casting and from at least every 20 m<sup>3</sup> of concrete of each grade placed.”



#### **7.4 TESTING (SUBCLAUSE 7.2)**

##### **7.4.5 Watertightness Test (New Subclause 7.2.5)**

All water retaining structures shall be tested as follows:

Any openings in the structure, including those allowed for equipment to be provided at a later stage by the Mechanical and Electrical Contractor, shall be fitted with temporary watertight closures. The closures shall be fabricated from steel plate of thickness determined by the Contractor, but with a minimum of 5 mm. The closures shall be provided with suitable seals and shall be held in place by props or anchor bolts. Thereafter, and once agreed with the Engineer, the structure shall be filled with clean water (river water is acceptable) until the maximum allowable water level has been reached. The Contractor shall provide, set up and ultimately remove an apparatus suitable for conveniently and accurately measuring the water level to within 0,5 mm. The structure shall be allowed to remain filled for a period of seven days during which time any loss of water which may occur shall be made up by filling the structure to top water level. At the beginning of the test, the water level shall then be carefully noted and recorded by the Engineer in relation to a fixed benchmark. The structure shall be allowed to remain filled for a period of seven days. During this period, the readings shall be taken by the Engineer.

Any loss of water which has occurred shall then be made up by filling the structure to top water level. The structure shall be left undisturbed for a period of not less than seven days, during which time the water level shall again be recorded by the Engineer at 24-hour intervals. The structure shall be considered watertight if the drop in level, excluding losses due to evaporation, does not exceed 10 mm in 7 days and no leakage or dampness is apparent. The exterior surfaces of walls shall be examined and any flows from under-drains recorded.

In the event of any leakage or dampness being evident at any stage of the filling or testing or in the event of the Engineer considering the final degree of watertightness to be unsatisfactory, the Contractor when ordered by the Engineer shall discontinue such filling or testing and shall, at his own expense, take approved steps immediately to rectify the leakage and to make the work thoroughly sound to the complete satisfaction of the Engineer. All such work of rectification shall be continued assiduously until a satisfactory test is obtained, which shall prove to the Engineer that watertightness has been obtained.

On successful completion of the watertightness test, the Contractor shall remove the temporary watertight closures, along with any anchor bolts, and shall grout the holes allowed for the anchor bolts with a non- shrink grout approved by the Engineer.

The Works will not be certified Practically Complete until the structure has been proved by testing to be watertight to the satisfaction of the Engineer.

If required by the Engineer, the structure shall be retested during and before the expiry of the Defects Liability Period.

##### **7.4.6 Testing Methodology (New Subclause 7.2.6)**

All measures required for obtaining, purchasing, tankering, pumping and/or piping the water are to be included in the price for testing.

Concrete work, which is required to contain water shall not be accepted as complete until it has been proved by test to be watertight. Testing shall not commence sooner than 14 days after the structure has been completed.

Neither backfilling around the Works up to original ground level nor banking around structures will be permitted until after the satisfactory completion of the appropriate stages of testing for watertightness in accordance with the provisions of this Clause as set out hereunder.

Water retaining structures are to be tested for watertightness at four stages unless otherwise ordered by the Engineer:

- one at quarter-full depth of water
- one at half-full
- one at three-quarter-full
- one at normal full level.

Testing at each level should be carried out as detailed below.

Preparation:

Fill the tank with potable water to the appropriate level and leave to stand for at least 24 hr.

Measurement.

Measure the drop in liquid level over the next 72 hr to determine the liquid volume loss for comparison with the allowable leakage. Evaporative losses shall be measured or calculated and deducted from the measured loss to determine the net liquid loss (leakage). The net liquid loss for a period of 24 hr shall not exceed 0.05 of 1 percent of the tank capacity at that level of testing.

Extension of test duration.

If the leakage exceeds the maximum allowable, the leakage test shall be extended to a total of five days. If at the end of five days the average daily leakage does not exceed the maximum allowable, the test shall be considered satisfactory.

If the net liquid loss exceeds the maximum allowable, leakage shall be considered excessive and the tank shall be repaired, re-disinfected, and re-tested at the Contractors expense until leakage falls within the appropriate limit. If any retest fails to reveal a satisfactory degree of watertightness, the Contractor shall carry out such other measures at his own expense as may be directed by the Engineer.

Damp spots.

Damp spots on the exterior wall surface or measurable leakage of water at the wall base shall not be permitted. Damp spots are defined as spots where moisture can be picked up on a dry hand. The source of water movement through the wall shall be located and permanently sealed in an acceptable manner. Leakage through the wall-base joint or footing shall likewise be corrected. Damp spots on the footing are generally to be expected and are permissible.

In the event of leakage being evident at any time during the Defects Liability Period,

the Engineer before issuing the Final Certificate may call for further testing and rectification as already described and will have the right to withhold his Certificate until he considers the work to be satisfactory.

#### 7.4.7 Durability Testing (New Subclause 7.2.7)

Concrete shall comply with the durability parameters defined below:

1) Water Sorptivity:

Sorptivity is sensitive to surface effects and may be used to assess the effectiveness of initial curing.

2) Oxygen Permeability:

Permeability is sensitive to changes in the coarse pore fraction and is thus a means of assessing the degree of compaction of concrete. It may be used to quantify the microstructure of the concrete and is sensitive to macro-defects such as voids and cracks.

3) Chloride Conductivity:

Chloride conductivity provides a method of characterisation of concrete in the marine environment and may be used to assess the chloride resistance of concrete.

Unlike oxygen permeability and water sorptivity, chloride conductivity is not really a measure of construction quality, but it shall be used for materials selection and design of mixes in aggressive chloride conditions. It will therefore only be used as a check on mix designs during the initial stages of construction.

4) Concrete Cover:

Concrete cover is a dimensional indicator of cover concrete depth. Cover concrete is the outer concrete layer which protects the internal reinforcing steel, and its depth varies according to the requirements of the different environmental exposure classes.

Test for cover shall be conducted using an approved calibrated electromagnetic cover meter.

This test shall be conducted when instructed by the Engineer to confirm that the specified depth of concrete cover has been achieved. The cover meter tests shall cover at least 1 m<sup>2</sup> for every 10 m<sup>2</sup> exposed. The average cover of the 1 m<sup>2</sup> subjected to the test shall be used to determine the payment as per Table PSG 7.3.10.3 unless the Contractor chooses to carry out additional tests as detailed under clause PSG 7.3.8. The cover meter must be calibrated for each project by drilling and measuring actual cover in at least 3 locations to validate the readings.

5) General:

Durability predictions will be based on the following tests that shall be arranged by the contractor. The durability testing shall be carried out by a laboratory approved by the Engineer.

For testing, water sorptivity, oxygen permeability and chlorine conductivity, cores of 68 mm diameter shall be extracted from the structure when the concrete reaches the age of at least 28 days and tested for the durability criteria set out in PSG 7.3.7. The frequency of the testing at the start of the contract shall be such that there is at least one test (consisting of 2 cores) per discrete concrete element, or per 15 m<sup>3</sup> poured (whichever is the lesser), until such time that the Engineer is satisfied that the specified criteria are consistently achievable. Hereafter testing shall be limited to one test per discrete concrete element or maximum concrete pour of 40 m<sup>3</sup> (whichever is the lesser), or as directed by the Engineer. Depending on access requirements, the frequency and locations of the tests may be changed to suit site requirements as directed by the Engineer. Note that for decks and walls, the cores shall be taken on the exposed faces of the concrete i.e. the soffit and side wall face, taking care not to cut the reinforcing bars. Where the cores do contain pieces of reinforcing steel, they shall not be used for the tests, particularly in the chloride conductivity test or where bleeding cavities may have formed.

The cores shall be extracted through the cover concrete from the constructed concrete element and a slice (25 mm thick) shall then be cut from the outer surface of this core such that the slice is representative of the middle layer of the cover concrete, i.e. the middle layer being a 25 mm thick slice of concrete, 5 mm from the exposed outer surface extending in towards the reinforcement, and tested. The positions at which the cores shall be extracted shall be as indicated by the Engineer.

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 and durability of the structural element tested. The cost of drilling and filling of the holes shall be included in the rate make-up of pay items for durability testing.

#### **7.4.8 Depth of Concrete Cover (New Subclause 7.2.8)**

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. The number of readings taken to each 1 m<sup>2</sup> to be tested shall be such that an accurate average cover can be determined for the tested area.

#### **7.4.9 Shrinkage (New Subclause 7.2.10)**

The dry shrinkage tests shall be conducted in accordance with SANS 1085. The drying shrinkage shall not exceed 0.04%

### **7.5 Acceptance Criteria for Strength Concrete (SUBCLAUSE 7.3)**

*Add the following to Subclause*

#### **7.3.6 Durability Parameters Acceptance Ranges**

When tested in accordance with the test procedures described below for each potential durability parameter, the concrete shall meet the limits given in the tables below:

**7.3.6.1 Water Sorptivity And Oxygen Permeability**

Table PSG 7.3.6.1 Water Sorptivity and Oxygen Permeability		
Acceptance Category	Test No. / Description / Unit	
	Water Sorptivity (mm/h)	Oxygen Permeability (log scale)
Concrete made, cured and tested in laboratory	6	> 10.0
Full acceptance of in-situ cast concrete	< 8	> 9.15
Conditional acceptance of in-situ cast concrete (with remedial measures)	8 - 15	8.75 – 9.15
Rejection	> 15	< 8.75

**7.3.6.2 Chloride Conductivity**

Table PSG 7.3.6.2 Chloride Conductivity (severe to very severe conditions)								
Concrete	100% PC		10% CSF		30% FA		50% GGBS	
Curing Period								
Full wet cured								
Moist cured (3 – 7d)								

**7.3.6.3 Concrete Cover**

Table PSG 7.3.6.3 Concrete Cover			
Test Description	Specified Cover (mm)	Acceptance Range	
		Minimum	Maximum
Concrete cover to reinforcement	20 – 30	As specified	As specified + 5 mm
	30 - 80	As specified	As specified + 10 mm

**7.3.7 Criteria for The Compliance with The Requirements**

No extra payment shall be made for cube strength testing. The cost of cube strength testing shall be included in the rates tendered for concrete.

Water used for testing shall be free of charge except for failed tests when water will be charged at standard municipal rates.

In the event that the actual achieved average cube strengths of an element are less than 85% of the target mean strength, the Engineer may instruct the taking of cores for additional strength testing. The cost of taking the cores and repairing the holes in the structures shall be for the Contractor's account.

The Engineer will conduct routine tests for the durability parameters on cores taken from the completed elements during the construction, the costs for which shall be to the Employer's account unless the parameters are not met.

The test results shall be accepted or rejected based on the criteria as set out in Tables PSG 7.3.6.1, PSG 7.3.6.2 and PSG 7.3.6.3 based on the following categories:

(a) Full Acceptance: Concrete shall be accepted unconditionally, and full payment shall be made.

(b) Conditional Acceptance: Concrete may be accepted at the Engineer's discretion with a warning that construction methods be examined to improve the durability criteria. A reduced payment shall be applied to all the relevant pay items under SANS 1200 G for the non-conforming element or concrete pour as set out in Tables PSG 7.3.10.1, PSG 7.3.10.2 and PSG 7.3.10.3. Alternatively, the Contractor may elect to carry out remedial work to improve the durability of the concrete to the criterion of "Full Acceptance" to the satisfaction of the Engineer and receive full payment. All proposed remedial measures shall be subject to the approval of the Engineer. The cost of all such remedial work shall be for the Contractor's account.

(c) Rejection: The concrete shall be removed and replaced with fresh concrete at the expense of the Contractor, as directed by the Engineer.

Should the test result(s) indicate conditional acceptance or rejection of the item tested, the Contractor shall have the option of carrying out additional tests on that item, at his own expense, to confirm or disapprove the original test result(s). Not more than two such additional tests shall be carried out. Should one additional test confirm the original test result, then the original result shall serve to determine payment in accordance with Tables PSG 7.3.10.1, PSG 7.3.10.2 and PSG 7.3.10.3. If two additional tests are carried out and both such tests contradict the original test result(s) then the effective penalty as per Tables PSG 7.3.10.1, PSG 7.3.10.2 and PSG 7.3.10.3, based on the original test result(s), shall be halved.

### **7.3.8 Procedure In The Event Of Non-Compliance With The Requirements**

Structural concrete elements or concrete pours shall be represented by test cubes and extracted cores, which shall be tested for strengths and the appropriate durability parameters.

If the durability parameters have been proved acceptable, the costs for such testing shall be borne by the Employer. However, where non-compliance to the specified parameters has been identified, the assessed element shall be rejected and at the Engineer's sole discretion any of the following measures may be considered at the Contractor's expense:

(a) Coating with an approved product specifically designed to improve the non-conforming parameter depending on the severity of the test results.

(b) Acceptance at reduced payment.

(c) Demolition and rebuilding.

Where the Engineer allows conditional acceptance, reduced payment shall be applied to all the relevant pay items under SANS 1200 G for the non-conforming element or concrete pour according to Tables PSG 7.3.10.1, PSG 7.3.10.2 and PSG 7.3.10.3.

### 7.3.9 Tests Ordered By the Engineer

One concrete cube strength test shall comprise the results of tests carried out on three standard test cubes made from concrete sampled from one batch of concrete in accordance with these specifications.

### 7.3.10 Determination of Reduced Payment

Payments for all durability concrete shall be based on the test results. The durability parameters are calculated according to Tables PSG 7.3.10.1, PSG 7.3.10.2 and PSG 7.3.10.3 below.

Table PSG 7.3.10.1 Water Sorptivity

	Coastal ( $\leq 5$ km from coast and up to 15 km up river valleys/estuaries)		Inland ( $> 1$ km from coast)	
Water sorptivity (mm/h)	TEST RESULT	% PAYMENT	TEST RESULT	PAYMENT
	$< 8$	100%	$< 8$	100%
	$8 < 12$	90%	$\geq 8 < 12$	90%
	$12 < 15$	85%	$\geq 12 < 15$	85%
	$\geq 15$	0%	$\geq 15$	0%

Table PSG 7.3.10.2 Oxygen Permeability

	Coastal ( $\leq 5$ km from coast and up to 15 km up river valleys/estuaries)		Inland ( $> 1$ km from coast)	
Oxygen Permeability Index (log scale)	TEST RESULT	% PAYMENT	TEST RESULT	% PAYMENT
	$> 9.15$	100%	$> 9.5$	100%
	$> 9.0 \leq 9.15$	90%	$> 9.25 \leq 9.5$	90%
	$> 8.75 \leq 9.0$	85%	$> 9.0 \leq 9.25$	85%
	$\leq 8.75$	0%	$\leq 9.0$	0%

Table PSG 7.3.10.3 Concrete Cover

	Coastal ( $\leq 5$ km from coast and up to 15 km up river valleys/estuaries)		Inland ( $> 1$ km from coast)	
30 mm specified	TEST RESULT	% PAYMENT	TEST RESULT	% PAYMENT
	$\geq 30 \leq 40$	100 %	$\geq 30 \leq 40$	100 %
	$\geq 25 < 30$	40 %	$\geq 20 < 30$	40 %
	$< 25$ or $> 40$	0 %	$< 20$ or $> 40$	0 %



40 mm specified	$\geq 40 \leq 50$	100 %	$\geq 40 \leq 50$	100 %
	$\geq 35 < 40$	40 %	$\geq 30 < 40$	40 %
	$< 35 \text{ or } > 50$	0 %	$< 30 \text{ or } > 50$	0 %
50 mm specified	$\geq 50 \leq 60$	100 %	$\geq 50 \leq 60$	100 %
	$\geq 45 < 50$	40 %	$\geq 40 < 50$	40 %
	$< 45 \text{ or } > 60$	0 %	$< 40 \text{ or } > 60$	0 %
60mm specified	$\geq 60 \leq 70$	100 %	$\geq 60 \leq 70$	100 %
	$\geq 55 < 60$	40 %	$\geq 50 < 60$	40 %
	$< 55 \text{ or } > 70$	0 %	$< 50 \text{ or } > 70$	0 %
65mm specified	$\geq 65 \leq 75$	100 %	$\geq 65 \leq 75$	100 %
	$\geq 60 < 65$	40 %	$\geq 55 < 65$	40 %
	$< 60 \text{ or } > 75$	0 %	$< 55 \text{ or } > 75$	0 %
70mm specified	$\geq 75 \leq 85$	100 %	$\geq 75 \leq 85$	100 %
	$\geq 70 < 75$	40 %	$\geq 65 < 75$	40 %
	$< 70 \text{ or } > 85$	0 %	$< 65 \text{ or } > 85$	0 %
80mm specified	$\geq 80 \leq 90$	100 %	$\geq 80 \leq 90$	100 %
	$\geq 75 < 80$	40 %	$\geq 70 < 80$	40 %
	$< 75 \text{ or } > 90$	0 %	$< 70 > 90$	0 %

Percentage payment for concrete cover shall be based on the average result of the total number of cover meter tests performed on a particular concrete element.

The overall percentage payment applied to a concrete member shall be based on the average of the percentage payments applicable to each durability parameter, together with the percentage payment based on the strength requirements described in the project specifications.

The reduced payments shall apply to the relevant payment items scheduled in the Schedule of Quantities.

### 7.3.11 Grouting tests

The Contractor shall, where so ordered, carry out a site test for each grouting procedure and each grouting gang to be used. The tests shall be carried out on a dummy bedplate similar in configuration to that which is to be grouted, but not exceeding 1 m<sup>2</sup> in area unless otherwise ordered. When the dummy bedplate is dismantled, the underside shall show a minimum grout contact area of 80% with reasonably even distribution of the grout over the surface grouted except that, in the case of expanding grout, the minimum grout contact area shall be 95%. The test shall show evidence of good workmanship and materials and the results shall be to the satisfaction of the Engineer.

The Contractor shall, when so ordered, make standard test cubes from various grout mixtures and also subject them to compression tests to determine whether the specified strength has been achieved. Test procedures shall comply with the relevant requirements of SANS Subclauses 7.2.1 to 7.2.3.

### 7.3.12 Cleaning and Disinfection

The inside of all water retaining structures shall be sterilized before testing. Any re-testing that may be required shall be at the Contractor's expense.

The entire inside surface of the unit including columns and roof shall be thoroughly hosed down with water and brushed until properly cleaned of all dirt and other foreign matter.

The floor of the structure shall then be flooded to a depth of 150 mm with chlorinated water and dosed at the rate of 150 grams of chloride or lime to every cubic metre of water. The entire inside surface shall again be scrubbed using this water. The workers engaged in this operation shall wear rubber boots. On completion, the floor of the unit shall be swept clean.

The chlorinated water shall be stored until the free chlorine level has dropped to an acceptable level. No water used for testing or cleaning of equipment or structures shall be allowed to be discharged on to the site.

Upon final filling of all water retaining structures before a Certificate of Completion is issued the Contractor shall have the water tested and certified as suitable for human consumption. Should the water require additional chlorination this is to apply using a Specialist Consultant.

## 8 MEASUREMENT AND PAYMENT (CLAUSE 8)

### 8.3 MEASUREMENT AND RATES (CLAUSE 8.1)

#### 8.3.11 Formwork (Subclause 8.1.1)

*Delete "or splays over 20 mm x 20 mm" from the first line of Subclause 8.1.1.2. Add the following to Subclause*

*8.1.1.2:*

"Splays up to and including 40 mm x 40 mm will not be measured separately and will be deemed to be included in the formwork costs."

*Add the following new subclauses:*

"8.1.1.7 For construction joints at kickers (in accordance with new Subclause 5.5.7.6), all additional costs for formwork to edges (vertical kickers) will be deemed to be included in the rates tendered for vertical formwork to sides of walls and will not be measured separately in narrow widths.

8.1.1.8 No formwork will be measured to edges of blinding layers and no-fines concrete under structures and the cost thereof (if needed) will be deemed to be included in the rates tendered for concrete in blinding layers or no-fines concrete as applicable.

8.1.1.9 Back shuttering or formwork to top revealed surfaces of sloping - or conical formwork will only be measured to surfaces of over 40° and up to 85° to the horizontal.

8.1.1.10 Formwork to horizontal surfaces in enclosed structures/chambers such as valve chambers, manholes or sumps shall either be removed through the manhole cover opening or the contractor may use permanent formwork at his own cost as no claims in this regard will be considered."

### **8.3.12 Reinforcement (Subclause 8.1.2)**

*Delete SANS Subclause 8.1.2.2 and replace with the following:*

- “a) Mild steel and high tensile steel will be measured by mass for the diameters or range of diameters as scheduled.
- b) Welded mesh will be measured for each type and mass per square metre of mesh as scheduled.”

*Delete SANS Subclause 8.1.2.3 and replace with the following:*

- “a) The unit rate for steel bars shall cover the cost of supply, cutting, bending, placing in position, and fixing of the reinforcing and supporting steel scheduled. The rate shall also include the provision of all spacer devices and binding wire, as well as the cost of tests in terms of SANS 920.
- b) The unit rate for welded mesh shall cover the supply, cutting and placing of mesh, as well as the cost of all waste due to laps”.

### **8.3.13 Concrete (Subclause 8.1.3)**

*Add the following new Subclause 8.1.3.3 e):*

“The rates for concrete shall also cover:

- 8.3.13.1** the use of dolomitic aggregate where prescribed,
- 8.3.13.2** the cost of meeting the requirements of Clause 3.3.1 above,
- 8.3.13.3** the cost of the preparation of design mixes by an approved laboratory and submission for approval by the Engineer (see new SANS Subclause 5.5.1.1 in Clause 5.3.1 above),
- 8.3.13.4** the cost of non-designated joints (see Clause 2.2.1 above),
- 8.3.13.5** screeded finish of unformed surface as specified in new SANS Subclause 5.5.10.1 in Clause 5.3.8,
- 8.3.13.6** curing the concrete, and
- 8.3.13.7** all other requirements of SANS 1200G and the amendments to SANS 1200G where no payment items are provided in the Bill of Quantities.”

## **8.4 SCHEDULED CONCRETE ITEMS (CLAUSE 8.4)**

### **8.4.11 Unformed surface finishes (Subclause 8.4.4)**

*Add the following:*

“The rates for unformed surface finishes shall cover the cost of providing the respective surface finish as specified in Clause 5.3.8 above.”

## **8.5 JOINTS (SUBCLAUSE 8.5)**

*Add the following:*

“Only designated joints as shown on the drawings will be measured for payment according to the length of each type of joint constructed (see Clause 2.2.1 above). The rate shall cover the cost of all materials, labour and plant required to construct each type of joint specified on the drawings, including the cost of all shuttering, treatment of the joint as specified in SANS Subclause 5.5.7.3, the provision of chamfers as specified where concrete is exposed, as well as testing and repairing where necessary.

Non-designated joints will not be measured for payment.”

#### **8.6 GROUTING IN OF EQUIPMENT (SUBCLAUSE 8.7)**

*Add the following:*

“Grouting in of equipment (such as base plates for machines) provided by the Contractor or by the Mechanical and Electrical Contractor will be measured by the volume of grout used.

The rate shall cover the cost of the meeting the requirements of Clause 5.3.15 above, and the supply and floating in of grout under the plates to ensure solid and complete filling of the gap.”

#### **8.7 GROUTING IN OF HOLDING DOWN BOLTS AND MISCELLANEOUS METAL WORK (SUBCLAUSE 8.8)**

*Add the following:*

“Fixing and grouting in of holding down bolts will be measured by number. The rate shall cover the cost of meeting the requirements of Clause 5.3.15 above, and all items and operations necessary to ensure that the bolts are effectively and rigidly held in position during casting, complete with sleeved pockets, all as detailed on the drawings.”

#### **8.8 IMPERVIOUS MEMBRANE (NEW SUBCLAUSE 8.9)**

The impervious membrane will be measured by the surface area covered excluding laps and wastage. The rate shall cover the cost of the supply, laying, jointing of sheets as recommended by the supplier and final trimming of outer edges.

#### **8.9 NO-FINES CONCRETE (NEW SUBCLAUSE 8.10)**

No-fines concrete will be measured by area to the thickness as shown on the drawings or as scheduled.

The rate shall cover the cost of supplying materials, constructing and placing in position the no-fines concrete, and shall include for the steel-floated 20 mm mortar skim.

#### **8.10 PLINTHS (NEW SUBCLAUSE 8.11)**

The rate for concrete plinths shall include all formwork, reinforcement, non-Item 8.2

designated joints and wood- floated finish to exposed surfaces.

**8.11 SCREEDING (NEW SUBCLAUSE 8.12)**

Screeding (both special/proprietary floor finish screeding and granolithic screeding) will be measured by area. The rate shall cover the cost of the supply and application of the specified material, complete as specified, and in accordance with manufacturer's instructions for proprietary screeds, all to the approval of the Engineer. Repairs to unsatisfactory work will not be paid for.

The unit rate or lump sum shall cover the cost of all materials, labour and equipment required to provide the screed as specified in Clause 5.3.8 above. The rate shall include the steel float finish.

**8.12 CASTING ITEMS IN CONCRETE (NEW SUBCLAUSE 8.13)**

Items cast in concrete will be measured by number separately for each type of item. The rate shall cover the cost of complying with the requirements of Clause 5.3.12 above.

Notwithstanding SANS Subclause 8.2.6, the rate shall cover the cost of fixing in position and casting in the item as construction proceeds, irrespective of whether the Contractor chooses to fix the item in the formwork and cast it in directly or to box out a hole and grout the item in subsequently.

The item will either be provided by the Mechanical and Electrical Contractor or will be measured and paid for separately.

**8.13 PRECAST PAVING SLABS (NEW SUBCLAUSE 8.14)**

Precast paving slabs will be measured by the area paved.

The rate shall cover the cost of compacting the area, application of weed killer, supplying, laying and bedding the slabs, grouting the joints and filling any gaps, all as specified.

**8.14 MISCELLANEOUS/MINOR REINFORCED CONCRETE/BRICK STRUCTURES (NEW SUBCLAUSE 8.15)**

Where minor reinforced concrete and brick structures have been scheduled in the Bill of Quantities, the sum tendered for each item shall cover the cost of all material (including handrailing, banded grating, flooring, ladders where applicable, weir plates and handstops), plant and labour involved in constructing the said item (including 0,10 t of high tensile steel per m<sup>3</sup> of concrete where the amount of reinforcement is not indicated on the drawings) according to the drawings and relevant specifications. Unless otherwise stated in the Bill of Quantities, the sum tendered shall also cover the cost of all excavation and backfilling, and if applicable, watertightness testing.

**8.15 BREAKING INTO AND BUILDING ON TO EXISTING STRUCTURES (NEW SUBCLAUSE 8.16)**

Where it is necessary for the Contractor to break into and/or build into or onto an existing structure, such an activity shall be measured and paid by the sum.

The sums tendered shall cover the cost of dealing with the water in the existing structure (where applicable), breaking away existing concrete, penetration of exposed concrete surfaces, supply and application of a wet to dry epoxy, liaison with the Engineer and the Employer to facilitate the work as specified and all materials or activities not measured elsewhere to complete the construction as specified including joining materials, supply and epoxying in of dowel bars etc.

Where it is required to break into existing structures to build in new pipes, the rate tendered shall cover the cost of ensuring that a watertight seal is achieved.

**8.16 DOWELS (NEW SUBCLAUSE 8.17)**

Installation of dowels will be measured by number. The rate shall cover the cost of all materials, including the dowels and epoxy grout, and all labour and plant to execute the works as specified or shown on the drawings.

**8.17 WATERTIGHTNESS TESTING (NEW SUBCLAUSE 8.18)**

The supply of temporary watertight closures for openings in the structures shall be measured and paid for by number in the sizes scheduled. These closures shall be re-used where similar components of a structure are tested for watertightness individually and sequentially (such as for each filter in the filter block), and thus payment will only be made for supply of one set of closures.

Watertightness tests shall be paid by a lump sum separately for each structure, or by number for components of structures as scheduled. The sum or number shall cover the cost of all water, labour, equipment and materials to carry out the tests; as specified in Clause 7.2.1; including the installation of temporary watertight closures and associated props/anchors; and the rectifying of faults and re-testing to achieve a test result to the satisfaction of the Engineer. No extra payment will be made for re-testing during the Defects Liability Period if leaks in the structure have been observed, thus leading to the Engineer's instruction to undertake the re-testing.

**PSH STRUCTURAL STEELWORK (AMENDMENTS SANS 1200 H)**

**1. SCOPE (CLAUSE 1)**

No amendments.

**2. INTERPRETATIONS (CLAUSE 2)**

No amendments.

**3. MATERIALS (CLAUSE 3)**

**3.1 STRUCTURAL STEEL (SUBCLAUSE 3.1)**

*Add the following to the first paragraph of Subclause 3.1.1:*

“Unless otherwise stated, the grade of steel for all members (except for angles 50x50 and smaller) shall be Grade S355JR and shall comply with the requirements of SANS 1431.”

*Omit the word in the first paragraph of Subclause 3.1.1 “.stairs”*

**3.2 BOLTS, NUTS AND WASHERS (SUBCLAUSE 3.6)**

**3.2.1 Bolts and nuts (other than friction-grip) (Subclause 3.6.1)**

*Add the following:*

“All bolts, nuts and washers within water retaining structures or exposed to the rain, or with a diameter of 10 mm or less, all anchor bolts of any size in concrete or brickwork and all bolts of any size used in conjunction with stainless steel items, shall be manufactured from Grade 304L stainless steel.

All other bolts, nuts and washers with a diameter of 12 mm or greater shall be hot-dip galvanized to SANS 763. Nuts shall be tapped before galvanizing, taking into consideration the extra clearance necessary to allow for the thickness of galvanizing on the bolts. If, after installation, there is any indication that galvanizing has been stripped from either the nut or the bolt, both nut and bolt shall be removed and replaced.

All Bolts for structural steel shall be Class 8.8 bolts.”

**4. PLANT (CLAUSE 4)**

No amendments.

**5. CONSTRUCTION (CLAUSE 5)**

**5.1 DRAWINGS AND SHOP DETAILS (SUBCLAUSE 5.1)**

**5.1.1 Design drawings (Subclause 5.1.1)**

*Add the following:*



“The Contractor shall be solely responsible for the final verification of all steelwork dimensions before preparing his shop drawings and manufacturing any steelwork components.”

**5.1.2 Contractor provides shop details (Subclause 5.1.2)**

*Add the following:*

“The Contractor shall be responsible for the preparation, in accordance with SANS 0162:1993, of shop drawings and/or details. The drawings shall be submitted for approval at least two weeks prior to commencement of fabrication. The Engineer shall require seven working days for the approval of shop drawings/details submitted by the Contractor.”

**5.2 FABRICATION (SUBCLAUSE 5.2)**

**5.2.1 General (Subclause 5.2.1)**

*Add the following:*

“The main structural members shall be single full length.”

**5.2.2 Holes for fasteners (Subclause 5.2.4)**

*Add the following to Subclause 5.2.4.2:*

“Holes for fasteners shall be drilled. Punching of holes shall only be permitted with the written approval of the Engineer.”

**5.2.3 Welding (New Subclause 5.2.7)**

All welding shall be done by, or executed under the direct supervision of coded welders.

All welds shall be 6 mm FW continuous, unless otherwise specified or agreed.

**5.3 ASSEMBLY (SUBCLAUSE 5.3)**

**5.3.1 Protective treatment (Subclause 5.3.9)**

*Add the following:*

“Corrosion protection shall be done in accordance with Specification: General Note Drawing.”

**6. TOLERANCES (CLAUSE 6)**

No amendments.

**7. TESTING (CLAUSE 7)**

**7.1 TEST CERTIFICATES (SUBCLAUSE 7.1)**

*Add the following:*

BSC 557 Item 8.2

SCM 051 Ver 17

“Test certificates pertaining to steel used for the various members shall be supplied by the Contractor to the Engineer when requested.”

**8. MEASUREMENT AND PAYMENT (CLAUSE 8)**

**8.1 SCHEDULED ITEMS (SUBCLAUSE 8.3)**

**8.1.1 Structural steel (New Subclause 8.3.14)**

Items 8.3.1, 8.3.2, 8.3.3, 8.3.4, 8.3.5, and 8.3.13 shall not be measured and paid for separately but shall be consolidated into one item paid on the basis of a rate per ton.

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**PSHA STRUCTURAL STEEL (SUNDRY ITEMS) (AMENDMENTS SANS 1200 HA)**

**1. SCOPE (CLAUSE 1)**

No Amendments.

**2. INTERPRETATIONS (CLAUSE 2)**

No Amendments.

**3. MATERIALS (CLAUSE 3)**

**3.1 STRUCTURAL STEEL (SUBCLAUSE 3.1)**

Replace the words "Structural Steelwork" in the heading and in other relevant Clauses, to read "Aluminium, Stainless Steel and Structural Steel".

Add the following:

"Subclause 3.1 of the Amendments to SANS 1200 H shall apply."

**3.2 STAINLESS STEEL (NEW SUBCLAUSE 3.4)**

All stainless-steel items shall be Grade 304L material.

**3.3 ALUMINIUM (NEW SUBCLAUSE 3.5)**

All aluminium items shall be grade M57S material anodized in accordance with SANS 999 Grade 25.

**3.4 BOLTS, NUTS AND WASHERS (SUBCLAUSE 3.3)**

Add the following to Subclause 3.3.1:

"Clause 3.2.1 (SANS Subclause 3.6.1) of the Amendments to SANS 1200 H apply."

**4. PLANT (CLAUSE 4)**

No Amendments.

**5. CONSTRUCTION (CLAUSE 5)**

**5.1 FABRICATION AND ASSEMBLY (SUBCLAUSE 5.2)**

**5.1.1 Handrails (Subclause 5.2.6)**

Add the following:

"The handrails and guardrails shall be of Stainless Steel in accordance with SANS 10162 – Part 4

At certain positions where it shall be necessary to have infrequent access to parts of the works which shall normally be equipped with handrails, the handrails shall over the sections be replaced with guard chains. The guard chains shall consist of 8 mm diameter galvanized chain secured to the stanchions with hooks. It shall only be possible to unhook the chain at one end."

**5.1.2 Open grid floors (Subclause 5.2.8)**

Add the following to Subclause 5.2.8.1:

"Open grid floors shall be of Stainless Steel.

**5.1.3 Corrosion protection (New Subclause 5. 2.12)**

The chequer plate flooring panels and guard chains shall be hot-dip galvanized in accordance with Specification:

**6. TOLERANCES (CLAUSE 6)**

No amendments.

**7. TESTING (CLAUSE 7)**

No amendments.

**8. MEASUREMENT AND PAYMENT (CLAUSE 8)**

**8.1 SCHEDULED ITEMS (SUBCLAUSE 8.3)**

**8.1.1 Corrosion protection (Subclause 8.3.6)**

Replace the contents of Subclause 8.3.6 with the following:

"Corrosion protection will not be measured separately, the prices tendered for the steel items being held to include for the cost of corrosion protection as specified. (Refer to General notes drawing)."

**PSLB BEDDING (PIPES) (AMENDMENTS SANS 1200 LB)**

**PSLB 3 MATERIALS**

**PSLB 3.1 SELECTED GRANULAR MATERIAL**

Replace the contents of Sub-clause 3.1 with the following:

Selected bedding material shall comply with the following requirements:

- A maximum particle size of 20 mm
- A minimum grading modulus of 0,5
- A minimum CBR of 15% at 93% of Max Dry Density maximum density
- A maximum plasticity index of 10.

The Bedding shall be compacted to at least 93% of Max Dry Density maximum density (100% for sand).

**PSLB 3.2 Selected fill material**

Replace the contents of Sub-clause 3.2 with the following:

Selected fill material shall be free from vegetation and from lumps and stones of diameter exceeding 30 mm, and shall be obtained from the trench excavations or other necessary excavations on the site, on the approval of the Engineer. The material shall have a PI<6.

**PSLB 3.3 CLASS OF BEDDING**

Fibre cement pipes shall be classified as rigid pipes and shall be laid on a Class C bedding whilst PVC-U and HDPE pipes shall be classified as flexible and bedded in accordance with drawing LB 3 (d) of SANS 1200 LB.

**PSLB 5 CONSTRUCTION**

**PSLB 5.1.4 COMPACTING**

Substitute "90% of Max Dry Density" in Clause 5.1.4 with "93% of MDD (100% for sand)".

Add the following Clause:

**"PSLB 5.5 SPECIAL WATER HAZARDS**

In addition to the Contractor's responsibilities for dealing with water, as set out in PSA Clause 5, the Engineer may order the Contractor to place a crushed stone bedding layer (minimum thickness 150 mm) on the trench bottom. Nominally sized stone that conforms to the grading requirements of SANS 1023 shall be used. Should the trench bottom conditions remain unstable due to the nature of the soil and the degree of saturation, the Engineer may order the Contractor to install a filter fabric on the trench bottom prior to the provision of the stone layer. After placing the stone bedding, the filter fabric shall be folded over the stone with a minimum overlap of 300 mm to form an enclosed drain. The specified bedding material shall then be used to bed the pipe. The Contractor shall only provide and lay the stone bedding layer and filter fabric after receipt of the written order to do so from the Engineer."

**PSLB 8 MEASUREMENT AND PAYMENT**

Add the following payment items:

**“PSLB 8.2.6 GEOTEXTILE FILTER FABRIC**  
Unit: m<sup>2</sup>

Where the Engineer has authorised the use of geotextile filter fabric to be used with stone bedding in water-logged conditions, this shall be measured by area as:

2 x (specified minimum trench base width + specified depth of stone bedding mm) x nett length.

The tendered rate shall include the cost of supply, placing, cutting, waste and losses as a result of overlaps and over excavated trench widths. The grade of geotextile filter fabric shall be specified according to the circumstances.”

DRAFT DO NOT USE

**PSLD SEWERS (AMENDMENTS SANS 1200 LD)**

**LD 3 MATERIALS**

**PS LD 3.1 PIPES, FITTINGS, AND PIPE JOINTS**

**PS LD 3.5 MANHOLES, CHAMBERS, ETC.**

**PS LD 3.5.2 Precast Concrete Sections**

Add the following to LD 3.5.2:

Precast concrete sections with an inside diameter of at least 1 000 mm shall be used for manholes.

Where the angle between the inlet and outlet of the manhole deviates by more than 45 ° from the straight or where more than one inlet enter a manhole, the invert level of the outlet shall be 30 mm lower than the lowest inlet invert level.

The 1,95 m diameter lower sections of the pump sumps shall comply with SABS 677 Class C.

Sectional spun concrete cylinders shall have been manufactured from dolomitic aggregate.

**PS LD 3.5.7 Step Irons**

Substitute LD 3.5.7 with the following:

Step irons shall be installed in all manholes deeper than 1,2 m. Step irons shall consist of polypropylene coated 12 mm high tensile steel, such as Calcamite or similar. The installation of the step irons shall be in accordance with the specification of the manufacturer.

**LD 5 CONSTRUCTION**

**LD 5.4 CONNECTIONS TO MANHOLES**

Add the following to LD 5.4:

If the gradient of a pipe is more than 1:10, a vertical bend shall be used to connect up to the manhole. The Contractor shall take care that no low point is formed in the pipe as a result of the bend. If a pipe lies at a gradient of 1:10 (5,71°), a 11,25° bend cannot be used since a bend with an angle larger than the grade of the pipe will result in a low point. It is the responsibility of the Contractor to shorten the bend in order to create the required angle.

For pipes with a gradient of up to 1:10, the angle can be taken up by a joint in the manhole and if required, also by the joint between the short-length and first full pipe.

**LD 5.6 MANHOLES, INSPECTION CHAMBERS, ETC**

**PS LD 5.6.1 General**

Substitute LD 5.6.1(a) with the following:



Manholes shall be of asbestos cement and shall be constructed as shown on the drawings.

1. Final cover levels of manholes in streets and paved areas shall be to the same level as the street or paved area.
2. On side walks, lawns and garden areas the cover level shall be 20 mm above the final ground level.
3. In midblock sewers it shall be 50 mm above ground level.
4. In the veld 100 mm above natural ground level.

If a manhole is positioned at a low point or in a hollow where stormwater infiltration may occur, the manhole cover level must be raised to a level to avoid the danger of infiltration, or to a level as agreed with the Engineer.

If the manhole needs to be raised with more than 300 mm, AC sections with the same diameter shall be installed and sealed with epoxy.

**PS LD 5.6.3 Step Irons**

Add the following to LD 5.6.3:

Step irons shall only be installed in manholes deeper than 1,2 m.

In the case of sand traps the lowest step iron will be installed 300 mm above the floor of the manhole. An additional step iron shall be installed on the opposite side of the sand trap at the same level as the lowest step iron, as shown on the drawings.

**PS LD 5.11 LIFTING AND RELAYING OF EXISTING SEWER PIPES**

A section of the existing 150 mm diameter sewer line has to be removed, and replaced by a new sewer outside the platform. Before the existing sewer is removed, the new sewer must be in place, and have been connected to the existing manholes at each end, with the necessary over-pumping during the connecting up. An extra-over item is measured for the removal and disposal off-site of the existing pipe from the bottom of the trench which is measured separately as a normal pipe-trench, and the new pipe is measured separately.

**LD 7 TESTS**

**PS LD 7.1 GENERAL**

Add the following to LD 7.1.5:

All tests shall be repeated after the completion of backfilling of pipe trenches.

**LD 8 MEASUREMENT AND PAYMENT**

**LD 8.2 SCHEDULED ITEMS**

**PS LD 8.2.3 Manholes**

Add the following to LD 8.2.3:

**PS LD 8.2.3.1 Manholes** ..... Unit : No  
 BSC 557 Item 8.2 SCM 051 Ver 17

Manholes shall be measured complete as indicated on the drawings and the rate shall be all inclusive for benching, step irons, type 2A CI cover and frame, and it shall make provision for all additional excavation and backfilling.

The depth of manholes as mentioned in the schedule of quantities shall be measured from the final cover level to the outlet invert level (flow level).

**PS LD 8.2.6 Erf Connections ..... Unit : No**

Substitute LD 8.2.6 with the following:

Erf connections shall be laid up to 1,0 m within the erf boundary.

There will be distinguished between long, medium and short connections.

A long connection consists of a 100 mm dia x 45° junction, a 100 mm dia x 45° bend, 10 m of 100 mm dia pipe with a 100 mm dia end cap with marker.

A medium connection consists of a 100 mm dia x 45° junction, a 100 mm dia x 45° bend, 2 m of 100 mm dia pipe with a 100 mm dia end cap with marker.

A short connection consists of a 100 mm dia x 45° junction, 1 m of 100 mm dia pipe with a 100 mm dia end cap with marker.

150 mm connections shall be the same as above, but 150 mm dia pipes and fittings shall be used.

There will be distinguished between the various connections to different main-pipe diameters, as well as between the various depth increments. The depth increment for the connection shall be determined by the depth of the junction.

The rate shall be all inclusive and shall cover the cost of excavation, backfilling, bedding, pipes and fittings. An extra-over item for variation in pipe lengths is provided for connections, shorter or longer than specified and shall include the necessary excavation, bedding, backfilling, all material, etc. and will be also be measured under depth increments in the schedule of quantities.

The depth increment for the extra pipe lengths shall be determined by the depth of the end caps. If the deviations are negative, payment shall be reduced accordingly.

The rate for new erf connections on existing sewers shall also cover the cost of additional excavation and backfilling around the mains, cutting of pipes, handling of sewage flow, etc.

Imported material for bedding, fill blanket and main fill shall be measured and paid for under the relevant items for mains.

**PS LD 8.2.11 Connection To Existing Sewers ..... Unit : No**

Add the following to LD 8.2.11:

Separate items will be scheduled for each diameter of connecting pipe.

The tendered rate shall include full compensation for connecting the proposed pipe, to the existing manhole where applicable, breaking into the structure where applicable,

any additional channelling and benching associated with the connection, cutting the pipe to suit the connection, supplying and building in the short junction pipe, extra couplings, dealing with existing flow, preventing foreign material from entering the sewer and making the connection.

The excavation for pipelines, pipes, backfilling and manholes shall be measured separately.

Where a direct connection is made to an existing pipe, the rate covers all labour involved in opening the existing pipe, the removal of the existing end cap and disconnection at the pipe.

**PS LD 8.2.25 Decommission and removal of existing manholes ..... Unit : No**

The depth increments shall be specified. The rate shall be all inclusive and shall cover the cost of removal and disposal of the existing manhole cover slab, demolishing and disposal of the manhole structure up to 1.5 m from the ground surface and disposal and backfilling of the manhole with material from commercial sources compacted to 93% of Max Dry Density (100% for sand).

DRAFT DO NOT USE

**PSLE : STORMWATER DRAINAGE (AMENDMENTS SANS 1200 LE)**

**PSLE 3 MATERIALS**

**PSLE 3.1 CULVERT UNITS AND PIPES**

**PS LE 3.1 d) Skewed Ends**

Substitute LE 3.1(d) with the following:

Where pipe culverts are to be constructed with a skew angle of more than 20°, the skew ends shall be cut on site.

**LE 3.4 MANHOLES, CATCHPITS AND ACCESSORIES**

**PS LE 3.4.3 Manhole Covers, Grid Inlets, Etc.**

Substitute the last sentence in LE 3.4.3 with the following:

Covers and frames for manholes and grid inlets shall comply with the requirements of SABS 558 for Type 2A and Type 9D, respectively.

**LE 5 CONSTRUCTION**

**LE 5.1 TRENCH BOTTOM**

**PS LE 5.1.3 Unsuitable Founding Conditions**

Substitute "90 % of MDD maximum density" in LE 5.1.3 with "90 % of MDD maximum density (100 % for sand)".

**LE 5.2 BEDDING AND LAYING**

**PS LE 5.2.2 Pipe Culverts**

Add the following to LE 5.2.2:

All pipes shall be laid on a Class B bedding, as specified in SABS 1200 LB.

**LE 5.5 CATCHPITS, MANHOLES, INLETS, AND OUTLET STRUCTURES**

**PS LE 5.5.3 Plaster**

Add the following to LE 5.5.3:

No plaster is required for manholes or inlets, except where otherwise shown on the drawings or ordered in writing by the Engineer.

**PS LE 5.5.5 Precast Manholes & PS LE 5.5.7 : Precast Inlet And Outlet Structures**

Substitute LE 5.5.5 and LE 5.5.7 with the following:

Manholes and inlet and outlet structures shall be constructed in accordance with the details as shown on the drawings.

**LE 8 MEASUREMENT AND PAYMENT**

**LE 8.2 SCHEDULED ITEMS**

**PS LE 8.2.8 Supply And Install Manholes, Catchpits, and The Like ..... Unit : No**

Substitute LE 8.2.8 with the following:

The unit of measurement shall be the number of each, in the depth increments as scheduled, fully installed in accordance with the details shown on the drawings.

The rate shall cover the cost of excavating and backfilling with approved selected material from site borrow pits, stockpile or commercial sources, compacted to 93 % of Max Dry Density (100 % for sand), supplying and installing of all material and accessories, the inlet kerbs and the channel adjacent thereto as well as for the removal and spoil of all surplus material. The rate shall also include the connection of pipes to manholes, catchpits, etc. and of building pipes into the walls of such structures, but not for the cutting of skewed ends.

**PS LE 8.2.14 Supply And Install Subsurface Drains subsoil According To Drawings . Unit : m**

The length shall be measured on the centre line of the completed subsurface drain.

The rate shall cover the cost of supplying, transporting, off-loading and installing all materials as well as for cutting, wasting, overlapping and installing of the materials where applicable. The rate shall also cover excavation and disposal, and backfill with clean free-draing sand, all as per detail.

**PS LE 8.2.16 Stormwater Channel V- channel According To Drawings ..... Unit : m**

The length shall be measured on the centre line of the completed open stormwater channel.

The rate shall cover the cost of supplying, transporting, off-loading and installing all materials (G5). The rate shall also cover excavation and disposal, surface preparation and shaping, and supply and construction of the specified lining, all as per the detail.

**PSM ROADS (GENERAL) (AMENDMENTS SANS 1200 M)**

**PSM 6 TOLERANCES**

**PSM.6.4 LEVEL CONTROL OF ROAD LAYERS**

Add the following Clause:

“The Contractor shall submit at the time of requesting acceptance of a road layer a record of the surface levels of that section, taken at meterage intervals to coincide with the level pegs. A sample form is obtainable from the Engineer.”

**PSM 7 TESTING**

**PSM 7.1 GENERAL**

Add the following:

“The random sampling method of TMH 5, for the spotting of positions, for field density testing will not necessarily be applied by the Engineer’s Representative. Density testing shall be carried out where, in his opinion, the density of the compacted layer is suspect. The Contractor shall present the full width of the layer, between the stated linear stake values, for acceptance. Only in exceptional cases will partial widths of layer be accepted for testing.”

**PSM 7.3 ROUTINE INSPECTION AND TESTING**

Add the following:

“The request for acceptance of a layer shall be submitted in writing, specifying the exact location of the section and type of layer. On receipt of all these details the Engineer’s Representative will arrange for the necessary inspections and tests to satisfy himself that the road layer complies. Testing will be carried out as expeditiously as possible, and the results will be available within 48 hours of receipt of test request. The Contractor shall backfill the test holes left in the layer with a similar material to that of the layer tested and compact the material to a similar density. Concrete shall not be used.”

**PSM 8 MEASUREMENT AND PAYMENT**

**PSM 8.2 INSPECTION AND TESTING OF A ROAD LAYER**

Add the following:

“The cost of refilling and compacting the density test holes shall be included in the rate tendered for the construction of that layer.”

**PSME SUBBASE (AMENDMENTS SANS 1200 ME)**

**PSME 3 MATERIALS**

**PSME 3.2.1 SUBBASE MATERIAL**

Substitute ME 3.2.1 with the following:

“Materials of G5 quality for use in the unstabilised subbase shall comply with the requirements of SANS 1200 M 3.3.3.

Materials of G7 quality used for use in the unstabilised subbase shall comply with the requirements as specified in SANS 1200 M 3.3.3 with a maximum aggregate of 63mm diameter.”

**PSME 5 CONSTRUCTION**

**PSME 5.4.1 PLACING**

The subbase layer shall be 150mm thick unless shown otherwise on the drawings.

**PSME 6 TOLERANCES**

**PSME 6.1 Dimensions, Levels, etc.**

**PSME 6.1.1 GENERAL**

Add the following:

“For layers, constructed of subbase quality material, on which the bituminous surface will be placed, the tolerance for dimensions and level shall be as set out in SANS 1200 MF Clauses 6.1.2 to 6.1.6 inclusive.”



### C3.3 UMNGENI-UTHUKELA WATER PARTICULAR SPECIFICATIONS

In addition to the SANS Standard Specifications, the following UMngeni-uThukela Water Particular Specifications shall apply to this contract. They are not bound in with this Volume but are issued in a separate volume as "UMngeni-uThukela Water Particular Specifications".

UMngeni-uThukela Water Particular Specification for OHASA 1993 Health and Safety

General specification for electric motor operated valve actuators: Integral motor control type

Guideline for detailed design, engineering and procurement

Guideline for hazard and operability study (HAZOP)

Guideline for pipeline and instrument diagram (P&ID)

Guideline for preliminary design

Particular specification for 164mm to 2230mm diameter steel pipe, specials, coatings and linings

Particular specification for blockwork

Particular specification for coating repair of galvanised steel members

Particular specification for construction health and safety

Particular specification for environmental management of construction projects

Particular specification for instrumentation

Particular specification for steel pipe insulating flange joints

Particular specification for valves

Specification wedge for gate and resilient seal gate valves

Quality Assurance procedure

Project specification for concrete

Project specification for steel pipes laid inside a tunnel

Asset numbering standard

Specification for double flanged butterfly valves for sizes from 400NB where the working pressure does not exceed 40 Bar (4000kPa)

Standard specification for ductile iron pipes, fittings and accessories

Standard specification for mechanical works

Technical specification for air release and vacuum break valve

Technical specification for electrical installations

Technical specification of materials and workmanship for cathodic protection installations

Asset management standards specification operations and maintenance (O&M) manuals

Industrial relations guidelines

SCADA Standard specification

Requirement for innovative wiring systems on UMngeni-uThukela Water sites

National Water Act

Regulations regarding the procedural requirements for water use license applications and appeals

Specification for colour coding

Instruments and Instrumentation specification

National norms and standards for disposal of waste to landfill

## C3.4 AMENDMENTS TO THE UMNGENI-UTHUKELA WATER PARTICULAR SPECIFICATIONS

In certain clauses the standard, standardized and particular specifications allow a choice to be specified in the project specifications between alternative materials and / or methods of construction and / or for additional requirements to be specified to suit a particular contract. Details of such alternative or additional requirements applicable to this contract are contained in this part of the project specifications. It also contains additional specifications required for this particular contract.

### C3.4.1 UMNGENI-UTHUKELA WATER PARTICULAR SPECIFICATION FOR 164mm to 2230mm DIAMETER STEEL PIPE, SPECIALS, COATINGS AND LININGS (copy is bound into this document)

#### 1.1 SCOPE

*Insert: Where references are made to SABS, read SANS.*

#### 2.3 FABRICATION OF SPECIALS

*Insert: When a belled or plain ended pipe is cut, one piece of that pipe will become a plain ended pipe. To enable two plain ended pipes of diameter less than DN 600 to be joined by fillet welding, steel sleeves shall be supplied. The sleeves shall have a width of 100mm, an internal diameter of 3mm greater than the outside diameter of the pipe, and a plate thickness and grade of steel identical to that of the pipes.*

#### 4.3 PIPE COATING SYSTEM 2: FUSION-BONDED MEDIUM DENSITY POLYETHYLENE COATING

##### 4.3.1.2 Repairs

*In the third line after "per 9m" insert "or 12m length of pipe and 4 repairs per 18m"*

#### 5 PIPE LININGS

##### 5.2 Pipe Lining System 1: Cement Mortar Lining

*Add to the end of this clause: "Pipes shall not be despatched until at least 10 days have elapsed since the lining was applied".*

### C3.4.2 UMNGENI-UTHUKELA WATER PARTICULAR SPECIFICATION FOR WEDGE GATE AND RESILIENT SEAL VALVES

Clause 3.1 The medium is potable water.

Clause 3.4 All valves shall be double flanged.

The flange drilling shall be as shown on the drawings or as specified in Clause PSL 3.8.3.

The pressure rating shall be as shown on the drawings and scheduled in the Bill of Quantities.

### C3.4.3 AMENDMENTS TO THE PARTICULAR SPECIFICATION FOR VALVES

Clause 2.1 *Delete this clause*

Clause 2.2 The medium is potable water.

C3.97

The nominal bore and pressure class shall be as shown on the drawings and scheduled in the Bill of Quantities.

The body shall be wafer type

The disc material shall be 316 stainless steel

The liner material shall be EPDM

O-Ring back-up on shaft is not permitted

Either corrosion protection option 1 or Option 2 may be used

Clause 2.3 *Delete this clause*

Clause 2.4 Extension Spindles are not required.

Clause 3.3 *Delete this clause* - it is superseded by the UMngeni-uThukela Water Particular Specification for Wedge Gate and Resilient Seal Valves.

Clause 3.4.5 Insert the following paragraph before the last paragraph:

“Whilst the Employer’s Agent will design the pipework installation, the Contractor must check and ensure that, if the disc extends beyond the valve body in the partly open or fully open position, it is not adversely affected by adjacent pipework or fittings i.e. that there is no contact with the adjoining pipe or fitting or, in particular, with cement mortar lining.

Where required flange drilling shall be as specified in Clause PSL 3.8.3.”

#### **C3.4.4 AMENDMENTS TO PARTICULAR SPECIFICATION FOR AIR RELEASE AND VACUUM BREAK VALVES**

Clause 2 The medium is potable water.

The nominal bores are as shown on the drawings and/or scheduled in the Bill of Quantities.

The pressure rating shall be as shown on the drawings and scheduled in the Bill of Quantities.

The cylindrical bodies shall be stainless steel and the end fusion bonded epoxy coated mild steel.

The ends shall be flanged with drilling as shown on the Drawings and specified in Clause PSL 3.8.3.

No valves need to operate at positive internal pipe pressures less than 0.5 bar. The design minimum positive internal pipe pressure is 1,5 bar.

#### **C3.4.5 AMENDMENTS TO PARTICULAR SPECIFICATION FOR PGL: DRILLING AND FIXING OF DOWELS AND ANCHOR BOLTS**

*Add to Clause PGL-2:*

The 25mm diameter dowel bars that are to be grouted into rock for the purpose of fixing concrete encasement of the steel pipe to the rock shall be grouted in with cement grout.

*Add to Clause PGL-3.2*

The 25mm diameter dowel bars that are to be grouted into rock for the purpose of fixing concrete encasement of the steel pipe to the rock shall be drilled 1,5m deep into rock as shown on the drawings.

DRAFT DO NOT USE

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## C3.5 PROJECT SPECIFICATIONS

The Project Specifications (PS) forms an integral part of the contract and supplements the Standard Specifications and UMngeni-uThukela Water Particular Specifications. The PS contain a general description of the Works, the Site and the requirements to be met by the Contractor.

In the event of any discrepancy between a part(s) of the Standardized or Particular Specifications and the PS, the PS shall take precedence. In the event of a discrepancy between the Specifications and the drawings and / or the Bill of Quantities, the drawings take precedence, thereafter the Bill of Quantities. In all events, the discrepancy shall be brought to the attention of the Employer's Agent before the execution of the work under the relevant item.

### PS 1 PROJECT DESCRIPTION

The current water sources supplying the South Coast of KwaZulu-Natal are insufficient to meet the present and projected future water demands. The Lower uMkhomazi Bulk Water Supply System (LUBWSS), is the recommended augmentation option increasing the supply to the existing Upper and Middle South Coast Supply area. This is currently being supplied from the uMngeni-uThukela System.

The LUBWSS will supply the coastal areas of eThekweni and the Ugu Municipality, from Amanzimtoti to Hibberdene which were connected to the existing South Coast Pipeline.

Phase 2 of the LUBWSS is described below:

**Phase 2** – A conventional potable Water Treatment Plant (WTP) with residual water treatment plant and associated infrastructure.

The construction contract is presented according to the design philosophy adopted, that is, Head of Works (Zone 1), Sedimentation (Zone 2), Filtration (Zone 3) and Residual Treatment Plant (Zone 4). The tender document will detail the water treatment plant layout and site infrastructure layouts before presenting the, structural, architectural, mechanical, electrical, and C&I design for each process component.

the book of drawings based on the on the zone design philosophy and should be used when completing the bill of quantities.

### PS 2 OVERVIEW AND DETAILS OF CONTRACT

#### PS 2.1 Overview

This Contract entails construction of the water treatment plant, together with the residual treatment plant and includes the following:

- Construction of all water retaining, reinforced concrete structures, chambers and buildings. This includes excavation to underside of structures.
- Installation and commissioning of mechanical equipment.
- Installation and commissioning of electrical equipment.
- Installation and commissioning of control and instrumentation equipment.
- Installation of IT infrastructure.
- Laying of all services and interconnecting pipework.
- Construction of stormwater management system.
- Road construction.
- Paving.
- Grassing.

- 
- Commissioning of the entire water treatment plant.
  - landscaping

## PS 2.2 Description of the work

A more detailed list of the components that are included in this contract is provided below.

### Water Treatment Plant:

- Construction of 1200 diameter raw water pipeline.
- Construction of inlet isolation valve chamber.
- Construction of flow meter chamber.
- Construction of chemical dosing facility and concrete dosing channel.
- Construction of splitter chamber 1.
- Construction of water tower.
- Construction of 5 No. clariflocculators .
- Construction of splitter chamber 2 and 3.
- Construction of 10 No. pulsator clarifiers .
- Construction of 10 No. rapid gravity sand filters .
- Construction of chlorine contact tank.
- Construction of header tank.
- Construction of chlorine disinfection facility.
- Construction of outlet flow meter chamber

### Water Treatment Residual Plant:

- Design verification/modification of residual treatment works
- Construction of backwash recovery tank.
- Construction of thin sludge tank.
- Construction of 3 No. gravity thickeners.
- Construction of thick sludge tank.
- Construction of supernatant recovery tank.
- Construction of sludge transfer and control facility.
- Construction of sludge dewatering and storage facility.

### Pipelines Systems:

- Interconnecting treatment water pipelines.
- Sludge collection and drainage pipelines.
- Chlorine dosing pipelines.
- Polymeric coagulant dosing pipelines.
- Potable water pipelines for dosing.
- Water sampling pipelines.
- Domestic water pipelines.
- Fire reticulation system.

### Building Infrastructure:

- Guard house.
- Chemical dosing building.
- Workshop.
- Chlorine disinfection building.
- Dewatering building,
- Sludge dewatering and storage facility.

## PS 3 DESCRIPTION OF SITE AND ACCESS

The WTP site is located close to the town of Craigieburn, near the N2 highway. The access route to the WTP can be achieved through the following route from Durban, KZN:

Travel on the N2 carriageway Southbound and take exit 117. Proceed onto P197 until Old Main Road. The site is located on the left of old Main Road. The GPS co-ordinates of the WTP 2 – Hull Valley are 30°11'53.13" S, 30° 44'57.69" E.

#### **PS 4 NATURE OF GROUND AND SUBSOIL CONDITIONS**

The site is gently to moderately sloping towards a stream which traverses the site from the northern to the south eastern boundary. The stream is situated near the eastern edge of the site.

Vegetation on site comprises of large trees, tall grass and shrubs. Tillite rock outcrops were observed in some areas of the site. The site was inferred to be underlain by colluvium, hydromorphic soils, ferricrete soils and residual soils derived from the weathering of the underlying Dwyka Group tillite.

Groundwater seepage was encountered at some inspection pits and boreholes and ranged from 0-4.9m below EGL. It is anticipated that the water table would rise should the existing trees such as blue gum, be removed from the site.

Refer to attached Geotechnical Report in the Annexures to the Site Information.

#### **PS 5 DRAWINGS**

##### **PS 5.1 Drawings Prepared by Employer**

The drawings listed in the table below were prepared and issued by the Employer for tendering purposes. They are issued separately to this document and must be regarded as provisional and preliminary for Tenderers to generally assess the scope of work. The characters in the "Rev. No." column below indicate the revision status of these drawings.

At commencement of the contract, the Employer's Agent shall deliver to the Contractor copies of the Construction Drawings and any instructions required for the commencement of the Works. Further drawings detailing reinforcement and bending schedules for the concrete chambers will be issued after Contract Commencement based on the Contractor's approved construction programme. From time to time thereafter during the progress of the works, the Employer's Agent will issue further drawings as may be necessary for adequate construction, completion and defects correction of the works. The work shall be carried out in accordance with the latest available revision of the drawings.

\*Refer to drawing register as per annexure C5.2

All drawings and specifications and copies thereof remain the property of the Employer, and the Contractor shall return all drawings and copies thereof to the Employer at the completion of the Contract.

#### **PS 6 CONSTRUCTION AND MANAGEMENT REQUIREMENTS**

The following parts of SANS 1921 Construction and management requirements for works contracts and associated specification data are applicable:

SANS 1921-1	General engineering and construction works
SANS 1921-2	Accommodation of Traffic on Public Roads



The associated specification data are as follows:

Clause	Specification data associated with SANS 1921- 1
	<b>Essential Data</b>
4.1.7	The requirements for drawings, information and calculations for which the Contractor is to be responsible is detailed in the project specifications.
4.2.1	The responsibility strategy assigned to the Contractor for the works is the Construction of the Works.
4.3	The planning, programme and method statements are to comply with the following: <ol style="list-style-type: none"> <li>1) The programme shall be prepared in bar (Gantt) chart form, preferably using a project management software tool such as <i>Microsoft Project</i> and shall be issued to the Employer's Agent in both hard copy and electronic format. The programme shall be structured to cover all items of work conceivable including all work to be done by Sub-Contractors and shall clearly indicate the critical path</li> <li>2) The programme must clearly show the intermediate milestone dates to be achieved taking the indicative construction sequences into account.</li> <li>3) In addition to any other constraints the construction sequence and timing shall take into account delays due to inclement weather, sourcing of local labour, community liaison, securing the site, approvals for wayleaves and other local authority requirements.</li> <li>4) Regular meetings must be held with the Employer's Agent.</li> <li>5) Method statements shall be prepared in accordance with the requirements of the project specifications.</li> </ol>
4.3.3	The period of notice shall be a minimum of one working day.
	<b>Variations</b>
All relevant	In all clauses where it appears, replace the word "Employer" with "Employer's Agent".
4.1.10	Where reference is made to "SANS 2001", substitute with "SANS 1200".
	<b>Additional Clauses</b>
4.6 (e)	Managing and disposing of water will include for by-pass arrangements, of temporary earthworks, cofferdams, pumping equipment, well-pointing, de-watering equipment etc. for dealing with all possible flows whether or not the existing flow path is being interfered with during installation of pipework.
4.7.4	No blasting will be permitted within 10m of any structure, pipeline or service unless the Contractor can satisfy the Employer's Agent that his proposed blasting methods and controls are such that no damage will be caused to the adjoining structure, pipeline or service. The Contractor will be required to provide equipment for and take vibro-recordings at no additional cost to the Employer.
4.8.1	The Contractor shall be responsible for protection from damage to any structures or services that might be affected by the excavations or works. The Contractor shall, before submitting his tender, carefully study the tender drawings and inspect on site the routes of the proposed pipelines and structures to be constructed in close proximity to existing structures and services and make due allowance in his rates for protection of structures and services by use of special construction methods such as close shoring, sheet piling.



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**PS 7 CONSTRUCTION PROGRAMME** (Read with SANS 1921-1:2004 Clause 4.3)

**PS 7.1 Preliminary Programme**

The preliminary programme submitted as part of the Tender Returnable Documents shall be in the form of a simplified bar chart with sufficient details to show clearly how the works will be performed within the time for completion as stated in the Contract Data.

Tenderers may submit tenders for an alternative Time for Completion in addition to a tender based on the specified Time for Completion. Each such alternative tender shall include a preliminary programme similar to the programme above for the execution of the works, and shall motivate his proposal clearly by stating all the financial implications of the alternative completion time.

The Contractor shall be deemed to have allowed fully in his tendered rates and prices as well as in his programme for all possible delays due to normal adverse weather conditions and special non-working days as specified in the Special Conditions of Contract, in the Project Specifications and in the Contract Data.

**PS 7.2 Programme in Terms of Clause 5.6 of the General Conditions of Contract**

It is essential that the construction programme, which shall conform in all respects to Clause 5.6 of the General Conditions of Contract, be furnished within the time stated in the Contract Data. The preliminary programme to be submitted with the tender shall be used as basis for this programme. The Contractor's attention is also drawn to Clause 5.7.3 of the General Conditions of Contract 2015.

The Contractor shall indicate on the programme all critical path activities. In this regard, the Contractor's attention is drawn to Clause 5.12 of the General Conditions of Contract, where consideration will only be given to claims for extension of time associated with critical path activities.

The Contractor's attention is drawn to PS 6 Clause 4.3

**PS 7.3 Submitted Programme**

The Contractor's programme, required in terms of Clause 5.6.1 of GCC 2015, shall be in a bar chart form (MS Project 2010 Gantt Chart format).

In addition to the requirements of Clause 5.6.1 of GCC 2015 the Contractor's programme shall show:

- a) the various activities, related to a time scale, for each element of the Works, including those of Nominated and/or Subcontractors, in sufficient detail to be able to assess construction progress,
- b) critical path activities and their dependencies,
- c) the date on which each structure is (i) ready for installation of equipment, and (b) ready for testing and commissioning of equipment, with these stages as defined in these Project Specifications,
- d) other key dates in respect of work to be carried out by others,
- e) key dates in respect of information to be provided by the Engineer and/or others, including reasonable and justifiable dates by when drawings detailing reinforcement and bending schedules for major components of each of the concrete structures are required.

In addition to the requirements of Clause 5.6.2.5 of GCC 2015, the Contractor shall submit with his programme, a copy of any network diagram used in producing the programme and showing the critical path activities (MS Project 2010).

If any change to the critical path occurs, the Contractor shall as soon as practicable notify the Engineer in writing.

The Contractor shall submit an updated project programme at each site meeting indicating actual versus scheduled progress and the aggregate progress, along with a written progress report.

The Contractor's programme and method statement will not be accepted as the basis for claims for additional compensation without due reference to all relevant associated factors.

#### **PS 7.4 General allowances**

When drawing up his programme, the Contractor shall, take into consideration and make allowance for, inter alia:

- a) expected weather conditions and their effects,
- b) known physical conditions or artificial obstructions,
- c) searching for, dealing with and carrying out alterations to the existing services,
- d) the accommodation of public access and traffic,
- e) the provision and implementation of the health and safety plan in terms of the Construction Regulations, 2003 of the Occupational Health and Safety Act,
- f) the design, testing and approval of the concrete mixes, and
- g) the requirements and programmes of those responsible for the "work carried out by others".

#### **PS 7.5 Coordination planning and programme**

When instructed by the Engineer, the Contractor shall, in consultation with the Engineer and the contractor for the WTW Contract, and the Mechanical and Electrical Contractor, draw up a detailed programme reflecting the completion of the Works including the installation, testing and commissioning of Mechanical and Electrical Work Contract equipment and all work required in completing the finishes to the buildings/structures, the grouting in of pipes and holding down bolts, and testing and commissioning of the whole of the Works. For this purpose, and to continue good communication and planning of the interfaces between the Contractor and the contractors for the WTW Contract and the Mechanical and Electrical Work Contract, the Contractor shall attend coordination meetings on a monthly basis.

#### **PS 7.6 Sequence of the Works**

##### **PS 7.6.1 General**

The Contractor shall construct the Works in such a manner that it allows the Mechanical and Electrical Contractor to commence construction and installation, testing and commissioning of equipment in good time before the Due Completion Date.

The Contractor shall thus construct the Works in accordance with the sequencing shown in the following table, and shall allow the Mechanical and Electrical Contractor unhindered access to structures (commencing from the date when the respective structure is ready for installation of equipment) as stipulated in the table:

#### **PS 7.7 Sequencing with the permanent access roads construction**

The permanent access roads constructed by the contractor for WTW Contract, will initially be used as a temporary gravel access road for that contract, and towards the end of that contract will be surfaced. The Contractor's temporary access road will be required to cross

the permanent access road as shown on the site layout drawings, and the Contractor shall move/re-align such crossings to accommodate the construction of the permanent access roads. The cost for such moving/re-aligning will be held to be included in the rates tendered for provision of the temporary access road..

#### **PS 7.8 Sequencing with other contracts for testing and commissioning**

Completion of construction related to the WTW Contract. Contract is planned to coincide with the Due Completion Date of the Works for this Contract. Thus, testing and commissioning of these other components of the project will commence together with the testing and commissioning of the Works in accordance with the sequencing detailed in PS6.1.4.1.

It is anticipated that the Raw water Gravity Main Contract and the Power Supply Contract will have been completed before the time testing and commissioning starts.

#### **PS 7.9 Costs for delays to Mechanical and Electrical Contractor**

Should the Contractor not adhere to the specified sequencing of the Works, he shall be liable for any costs resulting from consequent delay to the Mechanical and Electrical Contractor, including for claims for compensation due to associated delays claimed in terms of that contract.

#### **PS 7.10 Installation, testing and commissioning of equipment by others**

The Contractor's programme shall make provision for and clearly indicate the date on which each structure will be "ready for installation of equipment" and "ready for testing and commissioning of equipment" as defined below.

- a) "Ready for installation of equipment" means that:
- i) the structure is complete except in respect of matters such as floor screeds, benching, painting, which have to be done after the equipment has been erected,
  - ii) the structure has passed any required water test,
  - iii) the disturbed ground within 7 m of the structure with access routes has been compacted and levelled to allow vehicles and cranes to run and operate on it and is near final level to allow cables to be laid to the equipment,
  - iv) cable ducts around the specific structure in question have been laid under roads and backfill and compaction activities on all cable routes have been sufficiently completed to permit the installation of cables,
  - v) concrete has been sufficiently cured to allow installation of equipment and associated erection work to start,
  - vi) the structure and adjacent areas are clean and tidy, and
  - vii) the structure is in every way ready to accommodate the mechanical and electrical equipment.
- b) "Ready for testing and commissioning equipment" means that:
- i) all pipe and channel systems are sufficiently complete to allow the unit to operate,
  - ii) all works such as painting, benching, floor and trough screeds, grouting in bolts and concreting in of pipes which could not be done before installation of equipment have been completed and adequately cured (3 days for grout and 5 days for screeds), and
  - iii) the structure and adjacent ground are clean and tidy.

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**PS 7.11 Review of progress**

The Contractor shall review his progress each month and should progress lag behind the latest accepted programme, by more than 4 weeks, he shall submit a revised programme and method statement of how he proposes to make up the lost time. If, in the opinion of the Engineer, such revised programme will not make up the lost time, the Engineer shall have the right to request the Contractor to reorganize his work in a manner which will ensure an acceptable programme. Claims for additional payment to meet any costs incurred due to such reorganisation will not be accepted.

**PS 7.12 Methods and procedures PS 7.12.1 General**

The Contractor shall take sufficient and effective measures to reduce and limit excessive dust or wind-blown debris on the Site. Such measures shall include, but not limited to, watering down as frequently as necessary, covering up the sources and enclosing.

**PS 7.12.2 Neatness of the site**

The general neatness and tidiness of the Site are of particular concern.

The Works, being adjacent to the community, are in an environmentally sensitive area. The Contractor shall, therefore, on a day to day basis, keep the area of the Works in a condition acceptable to the Engineer.

**PS 7.12.3 Method statements**

When requested by the Engineer or as required in terms of the Health and Safety or Environmental regulations or specifications, the Contractor shall submit within 2 weeks (14 days) of date of such written request or otherwise at least 2 weeks (14 days) prior to when the particular activity is planned to commence, whichever time is the soonest, a method statement detailing the Contractor's proposed construction procedure of certain elements of the Works.

No work shall commence before the method statement has been submitted and approved. The approval shall not relieve the Contractor from his responsibilities in terms of the Contract.

**PS 7.13 Quality plans and control**

The Contractor shall prepare a quality management plan to be followed during the course of the Contract.

The quality management plan shall:

- a) clearly indicate the methods, programmes, procedures and other methods that the Contractor intends using as process control to ensure compliance of materials and workmanship with the requirements of the Contract (process control testing),
- b) include the proof of status of calibration of all measuring devices that are to be used during the course of the Contract.

**PS 7.14 Attendance on other contractors**

**PS 7.14.1 General**

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The sums tendered for the relevant items in Section A of the Bill of Quantities shall cover all the costs of providing the requirements specified with regard to attendance on and sequencing with other contractors, and associated planning and programming.

**PS 7.14.2 General attendance on Mechanical and Electrical Contractor**

The Contractor shall provide, during installation, testing and commissioning of the equipment, for use of the Mechanical and Electrical Contractor, the following at the site of the works:

- a) ablution facilities,
- b) water,
- c) power (for power tools),
- d) adequate working space, and
- e) ground-level access to and around the works for cranes and other vehicles required for installation of equipment.

**PS 7.14.3 Use of temporary access road**

The Contractor shall allow the Mechanical and Electrical Contractor and the contractor for the Power Supply Contract to make use of the temporary access road at all times.

**PS 7.14.4 Liaison between contractors**

Arising out of his duty in terms of Clause 4.8 of the General Conditions of Contract (GCC 2015), the Contractor shall liaise with the parties listed in 4.8.1.1 and 4.8.1.2 of that Clause and shall attend such meetings as required by the Engineer.

The Contractor shall liaise with, attend on and cooperate with the contractors for the Mechanical and Electrical Contract, the WTW Contract and Contract for the purposes of making connections, and for testing and commissioning.

**PS 7.15 Format of communications**

All contractual communications shall be in writing.

Any request for inspections by the Engineer shall be submitted to the Engineer in good time (i.e. 3 days for off-site inspections and 1 day for on-site inspections).

**PS 7.16 Key personnel**

The key personnel assigned to the Contractor's team shall as a minimum be as proposed by the Contractor in the tender offer. These staff shall not be replaced without the written permission of the Engineer. Should any of the staff at any time not be available for full-time assignment to the Contract, the Contractor shall submit the details of an alternative person with equivalent or better qualifications and experience to the Engineer for approval.

**PS 7.17 Management meetings**



The Contractor shall be required to attend the following site meetings during the currency of the contract:

- a) An inaugural site meeting, a maximum of three weeks after the Commencement Date.
- b) Monthly site meetings from the order to commence the works until the completion of the Works.
- d) Monthly coordination meeting with the Engineer and the Mechanical and Electrical Contractor until the completion of the Works.
- c) Four meetings during the Defects Liability Period.

During the currency of the Contract, the Contractor shall submit written reports every month (two days before each monthly site meeting) showing progress related to the agreed programme, and shall update his programme in accordance with actual progress.

The above requirements do not limit the Contractors responsibility in terms of the Contract to attend to defects and malfunctions during the Defects Liability Period.

#### **PS 7.18 Monthly labour returns**

The Contractor shall submit with each statement for payment a labour return showing the Number of Person Days and Labour Days recorded for the Contract. The returns shall be similar to the format approved by the Engineer.

#### **PS 7.19 Bonds and guarantees**

The form of guarantee is to be delivered to the Engineer, within the time period stated in the Contract Data and shall be in the format as provided in the Contract Data.

#### **PS 7.20 Payment certificates**

The statement to be submitted by the Contractor in terms of Clause 6.10 of the General Conditions of Contract shall be prepared in accordance with the standard payment certificate prescribed by the Engineer and shall be provided electronically in Microsoft Excel format. All costs incurred by the Contractor resulting from the preparation and submission of the statements shall be borne by the Contractor.

### **PS 8 SITE FACILITIES AVAILABLE**

#### **PS 8.1 Power Water and Sanitation Services**

eThekweni Municipality is the Water Supply Authority. There are potable connection within the WTP site. The Contractor shall make arrangements for a metered offtake with the WTP for ensuring an adequate supply of water for construction; including provision of on-site storage of sufficient capacity to allow uninterrupted construction.

Eskom is the Electrical Supply Authority. There is currently existing electrical supply within the WTP; there is sufficient spare capacity for construction purposes. The Contractor shall make his own arrangements for a metered offtake for the supply of electricity for construction purposes

eThekweni Municipality is the Water Supply Authority. There is a sewer connections within the WTP site. The Contractor shall make arrangements for a connection The Contractor is to make provision for ablution facilities on site. The construction and use of temporary septic tanks and soak-away (or the like) will not be permitted.

**PS 9 SITE FACILITIES REQUIRED**

**PS 9.1 Contractor's Site Establishment** *(Read with SANS 1921 - 1:2004 Clause 4.14)*

The Contractor will be provided with a suitable site for his camp on a property adjacent to the site for the Works and shall provide accommodation for his personnel and labourers off site.

**PS 9.2 Accommodation of Employees**

No accommodation for the Contractor's employees will be permitted on site. The Contractor shall make his own arrangements to house his employees and transport them to and from Site. No informal housing or squatting will be allowed.

**PS 9.4 Employer's Agent's Office**

Refer to the amendments and requirements for the Engineer's office in the Specifications PSAB.

**PS 9.4 Facilities for Construction Waste**

The Contractor shall make his own provisions for the collection, storage and disposal of all construction waste to an approved disposal site (i.e. whether it be in the camp or on the construction site); all in conformance with the Environmental Management Plan and with approval of the Employer's Agent, UW and the Environmental Officer. Payment for the clearing, loading, transport, dumping fees and any other requirement or costs incurred shall be included in the scheduled rates.

**PS 9.4 Sanitary Facilities**

The Contractor shall provide suitable and adequate portable chemical latrines for his employees and his sub-contractors. Latrines shall be provided at suitable positions throughout the site and shall be maintained by the Contractor in a clean and sanitary condition to the Employer's Agent's satisfaction. The use of latrines shall be enforced and fouling of the site will not be tolerated.

**PS 10 OCCUPATIONAL HEALTH AND SAFETY** *(Read with SANS 1921 - 1: 2004 Clause 4.18 and the Particular Specification for Construction Health and Safety)*

**PS 10.1 General Statement**

It is a requirement of this Contract that the Contractor shall provide a safe and healthy working environment and to direct all his activities in such a manner that his employees and any other persons, who may be directly affected by his activities, are not exposed to hazards to their health and safety. To this end, the Contractor shall assume full responsibility to conform to all the provisions of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) (OHASA), and the Construction Regulations 2014 issued under Section 43 of the OHASA by the Minister of Labour.

For the purpose of this Contract, the Contractor is required to confirm his status as mandatary of the Employer for the execution of the Contract by entering into an agreement

with the Employer in terms of the OHASA by executing the Agreement under C1.5 included in Section C1: Agreements and Contract Data.

### **PS 10.2 Health and Safety Specifications and Plans to be submitted at Tender Stage**

- (a) Employer's Health and Safety Specification  
The Employer's Health and Safety Specification is included in the tender documents in Annexure C5.5.
- (b) Contractor's Health and Safety Plan  
The Occupational Health and Safety Plan should be submitted at tender stage so as enable the Employer to determine whether the Contractor is capable of fulfilling the requirements of Construction Regulation 5(1)(h).

The successful Tenderer shall, on receipt of notification that he has been awarded the contract, submit without delay his own documented Health and Safety Plan for the execution of the work under the Contract. His Health and Safety Plan must at least cover the following:

- (i) a proper risk assessment of the works, risk items, work methods and procedures in terms of Construction Regulations 7 to 30 inclusive;
- (ii) pro-active identification of potential hazards and unsafe working conditions;
- (iii) provision of a safe working environment and equipment;
- (iv) statements of methods to ensure the health and safety of Sub-Contractors, employees and visitors to the site, including safety training in hazards and risk areas;
- (v) monitoring health and safety on the site of works on a regular basis, and keeping of records and registers as provided for in the Construction Regulations;
- (vi) details of the Construction Supervisor, the Construction Safety Officers and other competent persons he intends to appoint for the construction works;
- (vii) details of methods to ensure that his Health and Safety Plan is carried out effectively in accordance with the Construction Regulations 2014; and
- (viii) all other information and documentation that is required by the Employer, the Employer's Agent, or the agent who acts as a representative for the Employer, in order to enable the Employer to apply for a construction work permit in terms of Construction Regulation 3(1) (if required by law).

The Contractor's Health and Safety Plan will be subject to approval by the Employer, or his agent appointed as contemplated under the relevant provisions of the Construction Regulations 2014, and the Contractor's Health and Safety Plan may be required to be amended if necessary, before commencement of construction work. The Contractor will not be allowed to commence work, or his work will be suspended if he had already commenced work, before he has obtained the Employer's written approval of his Health and Safety Plan, and before the requirements of Construction Regulation 3, or Construction Regulation 4, as applicable, have been complied with.

Time lost due to delayed commencement or suspension of the work as a result of the Contractor's failure to obtain approval for his safety plan, or any failure on the part of the Contractor to submit the required information or documentation in support of the application for a construction work permit (in terms of Construction Regulation 3), or failure to give notification of construction work (in terms of Construction Regulation 4), as applicable, shall not be used as a reason to claim for extension of time or standing time and related costs.

### **PS 10.3 Cost of Compliance with the OHASA and Construction Regulations 2014**

The rates and prices tendered by the Contractor shall be deemed to include all costs for conforming to the requirements of the Occupational Health and Safety Act, 1993 (Act 85 of 1993) (OHASA), the Construction Regulations 2014, and the Employer's Health and Safety Specification as applicable to this Contract.

Should the Contractor fail to comply with any of the provisions of the OHASA, Construction Regulations 2014, or Employer's Health and Safety Specification, he shall be liable for penalties as provided for in any of the aforementioned documents.

Items that may qualify for remuneration will be specified in the Health and Safety Specifications, or in the Project Specifications.

#### **PS 11 ENVIRONMENTAL MANAGEMENT**

A sum has been included in the Bill of Quantities for the environmental rehabilitation to be carried out.

Refer to C3.7 for the Environmental Management Plan.

#### **PS 12 SELECTED SUB-CONTRACTORS**

Selected Sub-Contractors (refer to GCC 2015 Clause 4.4) shall be chosen and appointed as follows:

The Employer will prepare a detailed scope of work and/or specification for work to be done or goods to be supplied by a Selected Sub-Contractor.

The Employer and the Contractor will compile a list of firms or persons acceptable to both and who will be invited by the Contractor to submit tenders for the requisite work to be carried out or goods to be supplied by Selected Sub-Contractors. When the tenders are received they will be evaluated and the Employer will then indicate which tender he requires the Contractor to accept and he will advise the Contractor accordingly. The Contractor shall then accept that Tenderer and appoint him/her as a Selected Sub-Contractor.

The Contractor shall incorporate in the sub-contract, provisions that:

In respect of the work carried out or the goods that are the subject of the sub-contract, the Selected Sub-Contractor undertakes to the Contractor *mutatis mutandis* the obligations and liabilities as are imposed upon the Contractor to the Employer in terms of the Contract, and holds the Contractor harmless from and indemnifies him against the same and in respect of all claims, demands, lawsuits, damages, costs, charges and expenses whatsoever arising out of or in connection therewith, or arising out of or in connection with any failure to perform such obligations or to fulfil such liabilities, and

The Selected Sub-Contractor shall also hold the Contractor harmless from and indemnify him against:

- Shortcomings in the sub-contract work if and where the work was designed by the Selected Sub-Contractor;
- Defects in the goods if and where the goods were manufactured and / or supplied by the Selected Sub-Contractor;
- Any negligence by the Selected Sub-Contractor, his / her Agents, workmen and servants;
- Any misuse by the Selected Sub-Contractor of any Constructional Plant, Temporary Works or materials provided by the Contractor for the purposes of the Contract; and
- Any claims as aforesaid.

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**PS 13 QUALITY ASSURANCE**

The Contractor shall furnish the Employer a detailed Quality Control Plan (QCP) for the construction of the Works and shall be itemized by each portion of the Works and Task/Activity.

**PS14 SITE OFFICE, BOARDROOM & ABLUTION PREFABRICATED BUILDINGS**

**Site Preparation**

The site for the Engineer's and Employer's offices shall be cleared of all vegetation and topsoil shall be removed to a depth of 150mm and placed on the temporary stockpile. The substrate shall be inspected by the Engineer and the Engineer shall give the Contractor instructed to compact the substrate in situ or remove existing material and fill the site with suitable fill material to create a platform for the foundations of the prefabricated offices to be placed.

**Building Specification**

Prefabricated buildings to be engineered certified system consisting of pre-painted steel panels filled with 40mm polyurethane foam. Units to be placed on concrete plinths to manufacturers specifications with soil conditions prepared to manufacturers specifications. Floors to consist of welded or bolted galvanised frames, with floorboards and covering to manufacturers specifications to accommodate office loading. Internal and external walls to comprise of 40mm thick panels with pre-painted galvanised sheets. Walls to comply with SANS fire, energy and electrical requirements.

Roof and ceiling to manufacturers specification and to comply with fire, energy and electrical requirements specified in SANS. Plumbing and sanitary wear to be pre-installed in units and connected to site water and sewer connections. Windows and doors frame to be anodised aluminum with burglar proofing over all opening with blinds to be provided over all windows. All offices, kitchen and board/meeting rooms to have air conditioning pre-fitted (ablutions are excluded). Steps and handrails to be allowed for were required to comply with SANS regulations. Fire extinguishers and smoke detectors must be fitted on all prefabricated units.

**Accommodation Schedule**

The accommodation schedule for the prefabricated offices, laboratory and other offices for the Engineer and the Employer shall be as follows:

**PS14.1(a) Engineer's Offices (4 No.)**

All offices, facilities and equipment shall be new/ refurbished to new standard and be furnished, serviced, cleared and maintained by the Contractor.

The Contractor is to supply and maintain the following offices including the specification listed below for each office.

- Minimum internal Floor area of 9 m<sup>2</sup>
- Open concrete working floors
- L-Shape desk complete with drawers and locks
- Bar Fridge
- One swivel office chair for Engineer
- Minimum of two office chairs for guests
- Air conditioning unit with 2.2 kW minimum capacity mounted and with own power connection

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- General purpose steel cabinet with shelves
  - Steel filing cabinets with drawers
  - Two "Barhold" or similar wall mounted racks each with six clamps suitable for hanging A0 sized drawings.
  - White board (0.9m x 1.2m)
  - Pin board
  - Extractor fans installed complete with own power connection
  - Fire extinguishers, 9.0kg, all-purpose dry powder type complete with mounted on wall brackets
  - 220/250 volt power points
  - 400/231 volt 3-phase power points
  - Double 80-watt fluorescent light fittings complete with ballast and tubes.
  - Wash hand basin complete with taps and drains.
  - Bookcases
  - Voltage Stabilizers
  - Roller Blinds, Opaque type
  - Venetian blinds

**PS14.1(b)**

**Client's Offices (2 No.)**

- Minimum internal Floor area of 9 m<sup>2</sup>
- Open concrete working floors
- L-Shape desk complete with drawers and locks
- Bar Fridge
- One office chair for Client
- Minimum of two office chairs for guests
- Air conditioning unit with 2.2 kW minimum capacity mounted and with own power connection
- White Board (0.9m x 1.2m)
- General purpose steel cabinets with shelves
- Steel Filing cabinets with drawers
- Pin board
- Extractor fans installed complete with own power connection
- Fire extinguishers, 9.0kg, all-purpose dry powder type complete with mounted on wall brackets
- 220/250 volt power points
- 400/231 volt 3-phase power points
- Double 80-watt fluorescent light fittings complete with ballast and tubes
- Wash hand basin complete with taps and drains
- Bookcases
- Voltage Stabilizers
- Roller Blinds, Opaque type
- Venetian blinds

**PS14.1 (c)**

**Meeting Room (1 No.)**

- Minimum internal Floor area of 12 m<sup>2</sup>



- Open concrete working floors
- Roof over open concrete working floors.
- Meeting table to accommodate a minimum of 6 people
- Office chairs for a minimum of 6 people
- Air conditioning unit with 2.2 kW minimum capacity mounted and with own power connection
- White Board (0.9m x 1.2m)
- Extractor fans installed complete with own power connection.
- Fire extinguishers, 9.0kg, all-purpose dry powder type complete with mounted on wall brackets

**PS14.1 (d) Boardroom (1 No.)**

- Minimum internal Floor area of 20 m<sup>2</sup>
- Board room table to accommodate minimum of 10 people
- Office chairs for a minimum of 10 people
- Air conditioning unit with 2.2 kW minimum capacity mounted and with own power connection
- Extractor fans installed complete with own power connection.
- Fire extinguishers, 9.0kg, all-purpose dry powder type complete with mounted on wall brackets.

**PS4.1 (e) Drawing Room (1 No.)**

- Minimum internal Floor area of 9 m<sup>2</sup>
- Two "Barhold" or similar wall mounted racks each with 6 clamps suitable for hanging A0 sized drawings
- Office desk complete with drawers and locks
- Drawing tables (2 No.)
- Draughtsman stools (2 No.)
- Office chairs (3 No.)
- White board (0.9m x 1.2m)
- Pin board
- Air conditioning unit with 2.2 kW minimum capacity mounted and with own power connection
- Extractor fans installed complete with own power connection.
- Fire extinguishers, 9.0kg, all-purpose dry powder type complete with mounted on wall brackets

**PS14.1 (f) Kitchen (1 No.)**

- Minimum internal Floor area of 20m<sup>2</sup>
- one refrigerator of at least 100 litre capacity for general kitchen use.
- one kettle of at least 2 litre capacity
- one tea sets comprising twelve cups and saucers, twelve teaspoons, twelve forks, twelve butter knives, one teapot, one sugar bowl and one milk jug
- Double 80-watt fluorescent light fittings complete with ballast and tubes
- Sink basing complete with taps and drains



- Extractor fans installed complete with own power connection.
- Fire extinguishers, 9.0kg, all purpose dry powder type complete with mounted on wall brackets
- Air conditioning unit with 2.2 kW minimum capacity mounted and with own power connection.
- The provisions of gas installation, including gas storage cylinders, tubing, regulators, gas burners and shut-off valves

**PS14.1g) Laboratory (1 No.)**

- Minimum internal Floor area of 60 m<sup>2</sup>
- 220/250-volt power points
- 400/231 volt 3-phase power points
- Double 80-watt fluorescent light fittings complete with ballast and tubes
- Laboratory basins complete with swan-neck taps and drains
- Extractor fans installed complete with own power connection
- Fire extinguishers, 9.0kg, all-purpose dry powder type, complete, mounted on wall with brackets
- Air conditioning unit with 2.2 kW minimum capacity mounted and with own power connection
- General purpose steel cabinet with shelves
- Steel filing cabinets with drawers
- 6 no Highchairs
- Shelving as specified, complete with brackets
- Work benches complete with concrete slab top minimum thickness 75mm
- Work benches, complete with wooden top minimum thickness 25mm.
- Constant temperature baths and/or plastered brick
- Foundations for laboratory equipment
- Roller Blinds, opaque type
- Venetians blinds
- White board (0.9m x 1.2m)

**PS14.1 (h) Parking Bays**

- Concrete block paved and covered crommer deck parking for ten (10 no) vehicles(3x6m)IBR sheeting
- Un-covered parking space for six (6 no) vehicles
- 

**PS14.1 (i) Ablution facilities**

**Ablutions facilities including structure and connection to water and sanitation and power**, from separate male/female ablutions, ablutions blocks with changing room facilities,. These ablution units require, 2 basins, and 2 urinals and 2 toile for male, . These ablution units require, 2 basins, and and 3 toilet for female

- Minimum internal Floor area of 20 m<sup>2</sup>
- Double 80-watt fluorescent light fittings complete with ballast and tubes
- Sink and toilets basing complete with taps and drains



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**PS 15 Instrumentation Project Specifications**

See attached



PS-15-  
Instrumentation Project

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**PS 16 Mechanical Project Specification**

See attached



PS-16 Mechanical  
Project Specification.p

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**PS 17**     **HDPE Pipe Project Specifications**  
See attached



PS-17 HDPE Pipe  
Project Specifications.

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**PS 18**      **Ultrasonic Flow Meter Final V1 Particular Specification**  
See attached



PS-18 Ultrasonic Flow  
Meter FinalV1 Particul

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**PS 19 Electrical Distribution Equipment Specification**

See attached



PS-19 Electrical  
Project Specifications

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**PS 20 Building Lighting Schedule DATA**

See attached



PS-20 Building  
Lighting Schedule\_DATA

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**PS 21**      **Commissioning Plan**  
See attached



PS-21 The  
Commissioning Plan.p

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**PS 22 Pulsator Specification**

**PULSATOR TECHNOLOGY**

**Nominated Sub-Contractor or Specialist Contractor**

Pulsator Technology is propriety to Aquazur or later known as Degremont. The construction of 10off Pulsators forms part of this project and it will be either the nominated sub-contractor or specialist contractors' responsibility to supply a turnkey service to design, supply, install and commission the Pulsators successfully in accordance with the UMngeni-uThukela Specifications for mechanical and electrical equipment.

The Nominated Sub-Contractor or Specialist Contractor shall have a proven track record complete with contactable references of similar designs and successful completed projects over the last 25 years. Preference shall be given to tenderers who currently employ design engineers whom have been previously employed by Degremont SA.

The full scope of works that will form part of this tender but not limited to will be:

1. General Civil Layout Drawings
2. P&ID's
3. Mechanical Drawings
4. Electrical Requirement
5. Equipment Manufacturing Drawings
6. Equipment Sizing
7. Control Philosophies
8. Start-up and Commissioning Documents
9. O&M Documents

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**PS 23 Lime System Specification**

Lime System Specification

In order to eliminate funnel flow in the lime hopper/silo through vibrators and hammering, which leads to poor and erratic discharge, the hopper must be fitted with a mechanical bin activator or the arch breaker composed of turbine and flexible blade to avoid the clogging of lime inside the cone of the hopper/silo. The operation through the arch breaker should allow a smooth and compacted system ensuring a low maintenance and accuracy of 3% for the metering.

The metering conveyor screw must be fitted with an injector that protects the dry chemical from moisture during operation and standby phases. This prevents scaling, compaction and clogging.

The slurry tank should be ideal for use with hydrated lime slurry and ensure that there are no dust emissions.

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**PS 24 Filter Floor Specification****Filter Floor**General

The tender drawings for the filters indicate monolithic floors with an 800mm deep plenum cavity with a support system appropriate to a particular type of monolithic flooring system. The typical "Eaucon Proflor" system is preferred and no alternatives to the monolithic type floor arrangement will be considered. The system complete with the nozzles shall be locally manufactured in South Africa from a reputable manufacturer with ISO/TS 16949 and ISO 14001 certification. The Installation crew needs a proven track record with this typical system with official references of completed projects in and around South Africa. Tenderers shall submit comprehensive details of the proposed monolithic flooring system together with references from South African client bodies with contact details.

In pricing the filter floor item, the tenderer shall include for the following:

The design, including preparation of rebar details, concrete specification and proprietary sacrificial shutter, of the filter floor (minimum loading shall be +/- 100kPa) by an ECSA registered Professional Engineer with a minimum of 5 years' experience and a minimum professional indemnity cover of R5 000 000.00.

Supervision of construction of all filter floor by the Contractor's Professional Design Engineer. This design shall be submitted to the Employer's Agent for authorisation of construction and construction shall not commence until the Employer's Design Engineer has authorized the design in writing.

The design shall be based upon the exact dimensions indicated on the drawings. No change in the filter dimensions, reduction of plenum cavity or overall height of the filter complex will be permitted.

The minimum cover and side cover to rebar shall be 50mm.

Construction of the filter floor to the specified tolerances including for the supply and construction/ installation of:

- o Proprietary sacrificial shutter.
- o Reinforced concrete floor (Minimum Grade 30MPa, including rebar, specialist perimeter jointing together with associated support beams and/or columns as specified by the Contractor's Professional Design Engineer).
- o Filter grommets, nozzles and caps for pressure testing as specified below.

Pressure testing as specified below.

Air scour pattern "bubble" testing as specified below.

Sacrificial Shutter

The sacrificial shutter to the filter floor shall be constructed only from PVC or HIPS and no other material will be accepted. The design of the filter floor panels shall make provision to securely hold the filter grommet in position during the concreting operation. Both the flat panel type, supported and interlocked on short concrete filled PVC columns (preferred) and the corrugated type are acceptable.

The deflection under construction loading shall not compromise the specified level tolerances.

#### Filter Nozzles and Grommets

##### Filter Grommet

The filter grommet shall be cast into the filter panel. Particular care shall be taken in the casting operation to prevent the accumulation of air bubbles around the grommet as this could compromise filter floor panel integrity.

##### Filter Nozzle Requirements

The filter nozzles shall support the respective filter media without allowing any media to pass the nozzles into the plenum, and without the need for graded gravel support media. The nozzle slots shall not be larger than 30% of the media effective size but not more than 0.35 mm.

The nozzles shall be suitable for simultaneous air-scour and backwash and shall be provided with air metering orifice of such size as to evenly meter the air-scour between all nozzles, due cognisance being taken of the level tolerance between nozzles.

The filter nozzle shall incorporate an air metering orifice in the tail pipe in order to achieve a head loss of ~180mmWG at the air scour rate of 55 Nm<sup>3</sup>/m<sup>2</sup>/h for sound air distribution. In addition, a small orifice shall be located immediately below the sacrificial shutter to dispel the air cushion upon completion of the air scrubbing cycle. The filter nozzle shall be manufactured from polypropylene and shall incorporate a tailpipe at least 250 mm in length.

The filter nozzle shall have a head loss of ~ 250mmWG at the backwash rate of 18m<sup>3</sup>/m<sup>2</sup>/h.

The filter nozzle density shall be at least 52 nozzles /m<sup>2</sup> and the nozzles shall be levelled by laser or optical means to +/- 2mm (prior to fitment of shims). Nozzle density less than 52 Nozzles /m<sup>2</sup> will not be accepted. In order to achieve this level of accuracy, it is strongly recommended that the floor of the plenum chamber (upon which the support columns rest) be accurately constructed as well.

Once installed, the level of the filter nozzles shall be adjusted using shim washers to cater for any deviations that may occur in the concrete floor level, so as to achieve the specified maximum tolerance of deviation of +/- 1 mm.

##### Filter Nozzle Materials

The filter nozzles, the sleeves for the filter nozzles, the threaded sockets for the sleeves, and the sleeve caps shall be fabricated from polypropylene, or other material that is proven to be non-corroding, and which will not perish or become brittle when exposed continually to water containing a high-chlorine concentration.

##### Filter Nozzle Tolerances

Filter nozzle level (without shim washers) : +/- 2 mm (maximum deviation of highest to lowest point of 4 mm)

Filter nozzle level (once shimmed) : +/- 1 mm (maximum deviation of highest to lowest point of 2 mm)

Where stricter tolerances are recommended by the nozzle manufacturer, applicable equipment, these shall apply.

The Contractor shall make use of appropriate laser levelling equipment in conjunction with an experienced operator to record the level on each nozzle. He shall provide the

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Employer's Agent with a table recording these levels and with a copy of the valid calibration certificate for the instrument used.

#### Pressure Test

##### Post Floor Installation

After the filter floor has been installed and the grouting/jointing has cured, the Contractor shall pressure test the false floor in each filter before the protective caps for the nozzle sleeves are removed. In this regard the Contractor shall:

- a) Fill the underside of the filter floor with water leaving an air gap of about 25mm to 50mm (to be measured by removing one of the caps and using a dip tube).
- b) Cover the top of the false floor with water to a depth of between 100 mm and 150 mm (above the top of the false floor).
- c) Erect a standpipe to ensure that over-pressurisation cannot take place. The bottom end of the standpipe should be below air/water interface in the filter and the top end should be at a level equivalent to the maximum test pressure. The standpipe shall be at least 50 mm diameter and shall be connected to the plenum drain valve.
- d) Carefully examine for leaks around the nozzle sleeves and the perimeter side wall joints and mark the positions of any leaks evidenced by air bubbles.
- e) Make good all leaks with a concrete repair grout approved by the Employer's Agent.
- f) After the mortar has cured re-test as before, repeating the entire process until the leaks have stopped and have been remedied to the approval of the Employer's Agent.

#### Pressure Testing

Pressure testing of all filter floors shall be implemented once 28-day strength is achieved. This shall be implemented by sealing all nozzle orifices and applying a hydraulic pressure of 60 kPa having ensured that all air has been bled from the plenum chamber.

#### Air Scour Pattern Testing

Pattern testing shall be carried out on all filter floors. The empty filter bed shall be filled with water until the water level is 100mm to 150 mm above the filter nozzles. Air, from the air blower, shall then be introduced under the floor at the air scour rate such rate. The air distribution pattern shall be even with no "dead spots" or "boiling". Any discrepancies shall be rectified and the test repeated.

**C3.6 Project Specific OH&S Specifications**

See attached



C3.6 Project Specific  
HSE Specifications.pdf

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**C3.7 Environmental Management Plan**

See attached



C3.7 Environmental  
Management.pdf

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## Part C4: Site Information

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C4.1	LOCALITY PLAN	C4.1
C4.2	DESCRIPTION OF AND ACCESS TO THE SITE	C4.2
C4.3	ATMOSPHERIC / CLIMATIC CONDITIONS	C4.3
C4.4	NATURE OF THE GROUND AND SUBSOIL CONDITIONS	C4.4

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**C4.1. LOCALITY PLAN**



**C4.2 DESCRIPTION OF AND ACCESS TO THE SITE**

The WTP will be located close to the town of Craigieburn, near the N2 highway. The access route to the WTP can be achieved through the following route from Durban, KZN:

Travel on the N2 carriageway Southbound and take exit 117. Proceed onto P197 until Old Main Road. The site is located on the left of old Main Road. The GPS co-ordinates of the WTP 2 – Hull Valley are 30°11'53.13" S, 30° 44'57.69" E.

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### C4.3 ATMOSPHERIC / CLIMATIC CONDITIONS

In terms of GCC 2015, Clause 5.12.2.2, extension of time will be considered for abnormal climatic conditions in accordance with the following:

The number of days per month on which work is expected not to be possible as a result of normal rainfall, and for which the Contractor shall make provision in his tendered rates, prices and programme, are listed in the table below. Only the number of days lost as a result of abnormal rainfall, exceeding the number of days listed in table, will qualify for consideration of extension of time.

**TABLE: EXPECTED NUMBER OF WORKING DAYS LOST PER MONTH DUE TO NORMAL RAINFALL**

MONTH	Expected number of working days lost as result of normal rainfall	Average monthly Rainfall (mm)
JANUARY	*4	97
FEBRUARY	3	81
MARCH	3	91
APRIL	2	71
MAY	1	51
JUNE	0	12
JULY	1	75
AUGUST	1	49
SEPTEMBER	2	78
OCTOBER	4	119
NOVEMBER	3	123
DECEMBER	*3	145
<b>TOTAL</b>	<b>26 days</b>	<b>993</b>

*(The average monthly rainfall figures quoted are for the period 2009 to 2019 from the Umzinto Waterworks rainfall station No U8E900P01 monitored by UMngeni-uThukela Water on daily basis; they are included for information only, and shall not be taken into consideration for calculation of extension of time. The number of days lost are based on the number of days in each month that rainfall exceeded 10mm. \* The number of working days lost for December and January allows for the builders' holidays from 16 December to 9 January)*

During the execution of the Works, the Employer's Agent's Representative will certify a day lost due to abnormal climatic conditions only:

- if no work was possible on the relevant working day on any item which is on the critical path according to the latest approved construction programme; or
- if less than 30% of the work force and plant on site could work during that specific working day.

Extension of time as a result of abnormal climatic conditions shall be calculated monthly being equal to the number of working days certified by the Employer's Agent's Representative as lost due to rainfall to abnormal climatic conditions, less the number of days allowed for as stated in the table above, which could result in a negative figure for certain months. The total extension of time as a result of abnormal climatic conditions for which the Contractor may apply, shall be the cumulative algebraic sum of the monthly extensions. Should the sum thus obtained be negative, the extension of time shall be taken as nil.

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#### **C4.4 NATURE OF THE GROUND AND SUBSOIL CONDITIONS**

The site is gently to moderately sloping towards a stream which traverses the site from the Northern to the South Eastern boundary. The stream is situated near the Eastern edge of the site.

Vegetation on site comprises of large trees, tall grass and shrubs. Tillite rock outcrops were observed in some areas of the WTP site. The WTP site was inferred to be underlain by colluvium, hydromorphic soils, ferricrete soils and residual soils derived from the weathering of the underlying Dwyka Group tillite.

Groundwater seepage was encountered at some inspection pits and boreholes and ranged from 0-4.9m below EGL. It is anticipated that the water table would rise should the existing trees such as blue gum, be removed from the site.

Refer to attached Geotechnical Report.

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## Part C5: Annexures

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**ANNEXURE TO C5.1 UMNGENI-UTHUKELA WATER INSURANCE SUMMARY AND CLAIMS  
PROCEDURE**

**ANNEXURE TO C5.2 LIST OF DRAWINGS**

**ANNEXURE TO C5.3 BOQ IN EXCEL FORMAT**

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