

**MOKOLO AND CROCODILE
WATER AUGMENTATION PROJECT
PHASE 2 (MCWAP-2)**

TENDER NO 054/2024/PMID/MCWAP2/RFB

**PART C3.1
SPECIFICATION**

SECTION 1

GENERAL

PART C3.1 SPECIFICATION

SECTION 1 GENERAL

TABLE OF CONTENTS

	PAGE
SECTION 1	1
1.1 INTRODUCTION	1
1.1.1 Purpose of this Section	1
1.1.2 Definitions	1
1.1.3 Abbreviations	1
1.1.4 References.....	2
1.1.5 Description of the Project.....	2
1.2 SCOPE OF THE WORKS	3
1.2.1 Vlieëpoort Diversion Weir and Diversion Works.....	4
1.2.2 Low-Lift Pumping Station	5
1.2.3 Low-Lift Rising Main	6
1.2.4 Sedimentation Works.....	7
1.2.5 Balancing Reservoir.....	8
1.2.6 High-Lift Pumping Station	9
1.2.7 High-Lift Rising Main	11
1.2.8 Break Pressure Reservoir.....	12
1.2.9 Gravity Main.....	13
1.2.10 Other Control and Instrumentation Works	14
1.2.11 Other Electrical Work.....	15
1.2.12 General Work.....	15
1.2.13 General Obligations	16
1.2.14 Operation and Maintenance of Facilities	16
1.2.15 Ancillary Infrastructure	16
1.2.16 Upgrading and maintenance of existing roads during construction	17
1.3 THE SITE	17
1.3.1 Location of the Site	17
1.3.2 Climatic Data	17

PART C3.1 - SPECIFICATION

	1.3.3	Geotechnical Data	18
	1.3.4	Access to the Site: General	18
1.4		USE OF THE SITE	18
	1.4.1	Definitions and Use of the Site	18
	1.4.2	Legislative Requirements	19
	1.4.3	Security of the Site	19
	1.4.4	Property outside the Site	19
	1.4.5	Ownership of Natural Materials	19
	1.4.6	Ownership of Existing Structures and Equipment	19
	1.4.7	Existing Rights of Way	19
	1.4.8	Construction Establishment Areas	20
1.5		FACILITIES	21
1.6		FACILITIES PROVIDED BY THE EMPLOYER OR OTHERS	21
	1.6.1	General	21
	1.6.2	Construction Establishment Areas	22
	1.6.3	Electrical Power	22
	1.6.4	Water for Construction	22
	1.6.5	Potable Water	22
	1.6.6	Sewerage and Sewage Treatment	22
	1.6.7	Communication	23
	1.6.8	Borrow and Spoil Areas	23
1.7		FACILITIES TO BE PROVIDED BY THE CONTRACTOR FOR THE ENGINEER AND THE EMPLOYER (ENGINEER'S FACILITIES)	23
	1.7.1	General	23
	1.7.2	Interim Facilities	27
	1.7.3	Long-Term Facilities	28
	1.7.4	Assistants for the Engineer	29
	1.7.5	Medical	30
	1.7.6	Fire Control	30
	1.7.7	Construction Establishment Fencing and Security	30
	1.7.8	Sanitation and Cleaning	30
	1.7.9	Electrical Power	31
	1.7.10	Water Supply	31
	1.7.11	Sewerage and Sewage Treatment	32
	1.7.12	Construction Establishment Access Roads	32
	1.7.13	Communications	32
	1.7.14	Engineer's Site Equipment	34

PART C3.1 - SPECIFICATION

	1.7.15	Factory Acceptance Testing (FAT) and quality monitoring outside the borders of South Africa	34
1.8		FACILITIES PROVIDED BY THE CONTRACTOR FOR THE WORKS	35
	1.8.1	General.....	35
	1.8.2	Interim Facilities	36
	1.8.3	Long-Term Facilities	37
1.9		PROGRAMMING REQUIREMENTS	46
	1.9.1	General.....	46
	1.9.2	Programme Considerations	47
	1.9.3	Tendered Contract Programme.....	48
	1.9.4	Initial Programme	48
	1.9.5	Contract Programme.....	48
	1.9.6	Contract Programme Maintenance and Progress Monitoring.....	51
	1.9.7	Progress Meetings	52
1.10		CONSTRUCTION MATTERS AND RECORDS	53
	1.10.1	General Responsibilities.....	53
	1.10.2	Quality Management	55
	1.10.3	Contractor's Returns.....	59
	1.10.4	Management Meetings	62
	1.10.5	Integration Management.....	62
	1.10.6	Accommodation of Traffic	63
	1.10.7	Areas for Handling and Lay Down of Material.....	63
	1.10.8	Servicing during Defects Notification Period.....	63
	1.10.9	Mass Haul Planning for Pipeline Earthworks	64
	1.10.10	Integrated Cathodic Protection (CP).....	66
	1.10.11	Interfaces with Existing Infrastructure	67
	1.10.12	River Diversion	67
1.11		SOCIAL MANAGEMENT AND SOCIO-ECONOMIC DEVELOPMENT REQUIREMENTS	67
1.12		OCCUPATIONAL HEALTH AND SAFETY.....	68
1.13		ENVIRONMENTAL REQUIREMENTS.....	68
	1.13.1	General.....	68
	1.13.2	Project Specific Requirements.....	69
1.14		STANDARDS, DRAWINGS AND CORRESPONDENCE.....	70
	1.14.1	Standard Specifications.....	70
	1.14.2	Drawings and Co-ordination	70
	1.14.3	Correspondence to the Engineer	71
1.15		PRINCIPLES OF MEASUREMENT AND PAYMENT	71

PART C3.1 - SPECIFICATION

1.15.1	Bill of Quantities and Prices	71
1.15.2	Payment Item Descriptions	71
1.15.3	Prices to be Inclusive.....	71
1.15.4	Measurement Meetings.....	73
1.15.5	Bill of Quantities Structure	73
1.15.6	Preliminary and General Items and Evaluation.....	77
1.15.7	Payment Principles for Part A – Preliminary and General.....	78
1.15.8	Adjustment of TRC Sums	80
1.15.9	Measurement and Payment for Specification Section 1.....	81
1.15.10	Fixed Charges	82
1.15.11	Time-Related Charges	85
1.15.12	Quantity Proportional Charges	89
1.15.13	Provisional Sums	89
1.15.14	Performance payments (Not applicable to this Contract)	89
1.15.15	River Diversion	89

LIST OF TABLES

TABLE 1/1 OFFICE ACCOMMODATION REQUIREMENTS	24
TABLE 1/2 PROGRAMMES FOR METHOD STATEMENTS	54
TABLE 1/3 INITIAL METHOD STATEMENTS REQUIRED.....	54
TABLE 1/4 EMPLOYER DEFINED PORTIONS OF THE WORKS.....	76

LIST OF ANNEXURES

ANNEXURE 1/1 KEY METHOD STATEMENTS.....	91
ANNEXURE 1/2 SITE LABORATORY REQUIREMENTS.....	96
ANNEXURE 1/3 LABORATORY EQUIPMENT	98
ANNEXURE 1/4 PHOTOGRAPHIC LIBRARY STRUCTURE.....	110
ANNEXURE 1/5 ENGINEER’S SURVEY EQUIPMENT	112
ANNEXURE 1/6 INTEGRATION OF PIPE CONSTRUCTION TRAIN OF ACTIVITIES	114
ANNEXURE 1/7 PROJECT STRUCTURE DIAGRAM.....	117

SECTION 1

GENERAL

1.1 INTRODUCTION

1.1.1 Purpose of this Section

The Preamble to the Specification (Part C3.1A) informs the users regarding the structure and interfacing of the bespoke modular suite of specification sections. It is essential that users read the Preamble to understand the philosophy that constitutes the Specification in terms of the Contract.

This Section 1: General is the introductory Specification Section that shall be read in conjunction with all other Specification Sections that forms part of this integrated modular suite. Section 1: General informs about the “big picture” Scope of the Works, the Site and facilities, Programming (scheduling) requirements, and general construction matters and records, social and socio economic requirements, occupational health and safety requirements, environmental requirements and principles of measurement and payment.

1.1.2 Definitions

The Definitions as per the FIDIC Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer (Red book) or as amended in the Particular Conditions of Contract apply.

1.1.3 Abbreviations

AIA	:	Approved Inspection Authority
BoQ	:	Bill of Quantities
CD	:	Contractors Design
CMS	:	Construction Method Statement
DGEOT	:	Double Girder Electrical Operated Travelling - crane
DWS	:	Department of Water and Sanitation
ED	:	Employers Design
EIA	:	Environmental Impact Assessment
FC	:	Fixed Charge
ICC	:	Installation Completion Certificate
MCC	:	Motor Control Centre
MCWAP-2	:	Mokolo Crocodile Water Augmentation Project, Phase 2,
MHD	:	Mass Hall Diagram
MMS	:	Management Method Statement
OH	:	over head
OH&S	:	Occupational Health and Safety
PLC	:	Programmable Logic Controllers
PSD	:	Project Structure Diagram

PART C3.1 - SPECIFICATION

QCP	:	Quality Control Plan
RFC	:	Ready for Commissioning
RFO	:	Ready for Operation
RFPC	:	Ready for Pre-Commissioning
RFTO	:	Ready for Trial Operation
RMS	:	River Management System
SAPS	:	South African Police Force
SCADA	:	Supervisory Control and Data Acquisition
TCTA	:	Trans-Caledon Tunnel Authority
TRC	:	Time-Related Charge
UG	:	under ground
UPS	:	Uninterruptable Power Supply
WTW	:	Water Treatment Works

1.1.4 References

When reference is made to a Code of Practice, Specification or Standard, the reference shall be taken to mean the latest edition or replacement at time of tender of the Code, Specification or Standard; including addenda, supplements, modifications and revisions thereto. Where a previous version is intentionally used, it will be indicated as such. Where reference is made to a Code, Specification or Standard that has subsequently been withdrawn and not replaced, the intended content will remain relevant unless confirmed otherwise in writing by the Engineer.

1.1.5 Description of the Project

Major developments are planned for the Waterberg Coalfields, which are located in the Lephalale Area. As a direct result of the afore-mentioned developments, the water requirements in the Lephalale Area are expected to increase significantly in the future.

Due to the limited availability of water in the Lephalale Area, the DWS commissioned a Feasibility Study, which was completed in 2010, for the Mokolo Crocodile Water Augmentation Project (MCWAP) to establish how the future water requirements could be met.

A Phased Implementation Approach for the Complete MCWAP was defined to increase the supply as the future water requirements grow due to the envisaged developments of the Waterberg Coal Fields. The Feasibility Study was based on initial higher estimated water requirements. The Integrated Resource Plan (IRP) of 2010, which was subsequently updated, however, redefined the Country's future energy mix. Furthermore, Sasol decided to cancel their plans for developing Mafutha. Given the IRP and Sasol's decision, the envisaged future water requirements were significantly reduced and delayed compared to the Water Requirement Scenarios that were considered during the MCWAP Feasibility Study. Therefore, the Post Feasibility Bridging Study for the MCWAP-2 involved an Assessment of the Current and Future Water Requirements of the Key Rural, Urban and Industrial Development Areas in the Lephalale Area as well as a Review of the Required Transfer Capacity of the MCWAP-2. Based on the Conclusions and Recommendations of the Post Feasibility Bridging Study, the MCWAP-2 will be designed for a Transfer Capacity of 75 million m³/a.

PART C3.1 - SPECIFICATION

The phases of the Mokolo Crocodile Water Augmentation Project are:

- Phase 1 (MCWAP-1):
To augment the supply from the Mokolo Dam to supply in the growing water requirements for the interim period until a transfer pipeline from the Crocodile (West) River can be implemented. The MCWAP-1 therefore optimally utilise the full yield from the Mokolo Dam over the long term and will be operated as a system together with the MCWAP-2; and
- Phase 2 (MCWAP-2):
Transfer water from the Crocodile River (West) to the Steenbokpan and Lephalale areas, including the implementation of the River Management System (RMS) in the Crocodile River (West) down-stream of the Hartbeespoort and Klipvoor dams, and certain tributaries, up to the proposed Vlieëpoort Weir on the Crocodile (West) River near Thabazimbi.

MCWAP-1 has been implemented and is in operation. This Contract forms part of the implementation of MCWAP-2 which develops an initial capacity of 75 million m³/a with allowance for future extension, and includes the following Project Parts:

The implementation of MCWAP-2 is done using the following Construction Contracts:

- a) Abstraction Works including the Vlieëpoort Diversion Weir, Diversion Works and Low-Lift Pumping Station (Abstraction Works);
- b) Low-Lift Rising Main;
- c) Sedimentation Works;
- d) Balancing Reservoir;
- e) High-Lift Pumping Station;
- f) High-Lift Rising Main including a Break Pressure Tank and gravity section;
- g) Break Pressure Reservoir;
- h) Gravity Main with off-takes to users; and
- i) Ancillary Infrastructure.

The facilitation of the integrated systems commissioning for MCWAP-2 as well as the relevant systems integration with MCWAP-1 and the River Management System (RMS) forms part of this Contract. The complete MCWAP will be monitored from a central Operation and Control Centre constructed as part of this Contract No. 054/2024/PMID/MCWAP2/RFB. Refer to the Project Structure Diagram (PSD) on Drawing 2A-P2-001 in Annexure 1/7.

1.2 SCOPE OF THE WORKS

The detailed Scope of Works to be carried out is identified in the various Specification Sections and will comprise the construction, in accordance with the Specification, of Works which have been designed by the Employer together with the design and construction by the Contractor of certain mechanical, electrical and control and instrumentation works in accordance with Employer's Requirements.

The design of the Permanent Works outside the battery limits of the mechanical, electrical and control and instrumentation works is the responsibility of the Employer unless specifically indicated otherwise.

PART C3.1 - SPECIFICATION

The general overall Scope of the Works is summarised below. While this summarises the Permanent Works, it is not intended to define the scope of the Works comprehensively and in detail. The summary does not relieve the Contractor of his obligation to provide the complete installation in each case as per the Drawings and Specification Sections.

The work to be carried out under this Contract comprises inter alia the following: (Refer to Drawing 2A-P2-001 included in Annexure 1/7 for the Project Structure Diagram (PSD)).

1.2.1 Vlieëpoort Diversion Weir and Diversion Works**1.2.1.1 Civil Works**

Supply of Materials and construction of:

- a) Site clearing, grubbing, top soil removal and excavation;
- b) Access, coffer dams and river diversion (Temporary works);
- c) Jet grouted foundation stabilisation and deep grout curtain cut off;
- d) Additional geotechnical investigations;
- e) Gravity weir concrete structure with abstraction and river release facilities;
- f) Retaining walls, earth embankment and platform on the right bank;
- g) Fish ladder;
- h) Sediment and groundwater monitoring stations;
- i) Miscellaneous steelwork including manhole covers, open grid flooring, hand railing, access ladders etc.; and
- j) Erosion protection of riverbed and rehabilitation of river banks.

1.2.1.2 Mechanical Works

Design, documentation, Drawings, supply and installation of:

- a) Radial gates and sluices for river outlet and sediment scour;
- b) Hydro-mechanical operation of radial gates and sluices;
- c) Portal crane as well as crawl beams, crawl and block and tackle; and
- d) Pipe work, specials, reducers, flanges and fasteners associated with the Abstraction Works.

1.2.1.3 Electrical, Control and Instrumentation Works

Design, documentation, Drawings, supply and installation of:

- a) Power supply and cabling;
- b) Instrumentation on weir;
- c) Area lighting;
- d) Earthing and lightning protection;
- e) Instrumentation cabling; and
- f) Programmable Logic Controllers (PLC).

1.2.2 Low-Lift Pumping Station

This area is defined as a National Key Point (NKP) and shall comply with the requirements in the National Water Act, 1998 (Act No. 36 of 1998) and the Manual on Physical Security Measures at Departmental Works and Schemes.

1.2.2.1 Civil Works

Supply of Materials and construction of:

- a) Site clearing, grubbing, top soil removal and excavation;
- b) Reinforced concrete pump well;
- c) Concrete block paved loading bay / platform and parking;
- d) Local control room;
- e) Superstructure comprising reinforced concrete walls, face brick walls, reinforced concrete roof slabs, structural steel roof with IBR metal sheeting including all building services (water, sewerage and stormwater);
- f) Reinforced concrete valve, air, scour and flow meter chambers including all valves and flow meters;
- g) Miscellaneous steelwork including manhole covers, open grid flooring, hand railing, access ladders etc.;
- h) Ancillary buildings (Security etc.);
- i) Site works including access roads, stormwater drains, water supply, sanitation and security fences; and
- j) Gravel surfaced access road.

1.2.2.2 Mechanical Works

Design, documentation, Drawings, supply and installation of:

- a) Horizontal split-casing centrifugal low-lift pumps complete with motors;
- b) Overhead crane;
- c) Actuated suction and delivery isolating butterfly valves for each pump line;
- d) Pipe work, specials, reducers, flanges and fasteners associated with all pump lines;
- e) Seal pumps complete with associated valves and pipe work;
- f) Oil separator for sump pit;
- g) Sump pumps with associated valves and pipe work;
- h) Water Treatment Plant;
- i) Fire water pumps and associated valves and pipe work; and
- j) Ventilation systems and split unit air conditioning systems.

1.2.2.3 Electrical, Control and Instrumentation Works

Design, documentation, Drawings, supply and installation of:

- a) Medium voltage switchgear;
- b) Medium voltage protection;
- c) Metering;
- d) Medium voltage cable reticulation;
- e) Low voltage cable reticulation;
- f) Distribution transformers;
- g) Miniature substations;
- h) Ring main units (RMU);
- i) Low voltage cabling;
- j) Low voltage switchboards and motor control centres (MCC);
- k) Standby generator;
- l) Uninterruptible power supplies (UPS);
- m) Battery and battery chargers;
- n) Medium voltage variable speed drives;
- o) Medium voltage power factor correction;
- p) Motor surge protection;
- q) Earthing and lightning protection;
- r) Fire detection, protection, gas suppression and smoke ventilation system;
- s) Lighting and small power;
- t) Area lighting;
- u) Control and instrumentation;
- v) Access Control Biometric Systems;
- w) CCTV Systems;
- x) Instrumentation cabling;
- y) Programmable Logic Controllers (PLC);
- z) Managed Network Switches with Cabinets;
- aa) Microwave Radio Network (Mast Towers and Microwave Broadband Radios); and
- ab) Fibre optic network.

1.2.3 Low-Lift Rising Main

1.2.3.1 Civil Works

Supply of Materials and construction of:

- a) Site and pipeline route clearing and grubbing;
- b) Relocation of existing services;

PART C3.1 - SPECIFICATION

- c) Temporary fencing of the pipeline servitude;
- d) Removal and stockpiling of topsoil;
- e) Trench excavations;
- f) Blasting of hard material;
- g) Opening, development, management and closing / rehabilitation of borrow pits and spoil areas;
- h) Importing of suitable pipeline bedding and backfill material;
- i) Additional geotechnical investigations;
- j) Steel pipe manufacture;
- k) Two DN1000 pipelines (5.3 km) in parallel;
- l) Manufacture, supply, delivery and installation of pipe specials;
- m) Supply, delivery and installation of scour and air valve installations;
- n) Supply, delivery and installation of pipeline ancillaries (such as isolating and control valves and the like);
- o) Supply, delivery and installation of flow meters;
- p) Chambers;
- q) Stream and wet land crossings;
- r) Temporary and permanent cathodic protection;
- s) Trench backfilling and the disposal of unsuitable or surplus excavation materials;
- t) Armoured fibre optic cable;
- u) Monitoring stations at Dolomite areas and other special measures; and
- v) Interface and connections with pipework at other Parts.

1.2.3.2 Electrical, Control and Instrumentation Works

Design, documentation, Drawings, supply and installation of:

- a) Power supply to Low-Lift Pumping Station. (11 kV underground cables along the pipeline route);
- b) Fibre optic network cable line along the pipeline route;
- c) Microwave Radio Network (Mast Tower and Microwave Broadband Radio);
- d) Power supply to valve chambers and low voltage cabling;
- e) Control and instrumentation; and
- f) Instrumentation cabling.

1.2.4 Sedimentation Works**1.2.4.1 Civil Works**

Supply of Materials and construction of:

- a) Site clearing, grubbing and top soil removal;

PART C3.1 - SPECIFICATION

- b) Cut to fill excavation and import fill material from borrow pit for the earth embankment construction;
- c) Water retaining reinforced concrete structures;
- d) Inlet / outlet pipe work;
- e) Miscellaneous steelwork including manhole covers, open grid flooring, hand railing, access ladders, etc.;
- f) Scouring outlet and river scour channel, including energy dissipation outlet at river;
- g) Ancillary buildings;
- h) Site works including access road and fencing; and
- i) Rehabilitation of soil surfaces.

1.2.4.2 Mechanical Works

Design, documentation, Drawings, supply, delivery and installation of:

- a) Sluice gates to isolate the sedimentation canals, Balancing Reservoir feeder pipe and flushing pipe complete with ancillary Plant, limit switches, cables and panels as defined in the Specification and shown on the Drawings; and
- b) Actuated inlet isolating butterfly valves for each inlet and outlet pipe.

1.2.4.3 Electrical, Control and Instrumentation Works

Design, documentation, Drawings, supply and installation of:

- a) Power supply and cabling;
- b) Medium voltage and low voltage cable reticulation;
- c) Miniature substations;
- d) Lighting and small power;
- e) Earthing and lightning protection;
- f) Control and instrumentation;
- g) Instrumentation cabling;
- h) Programmable Logic Controllers (PLC); and
- i) Fibre optic network.

1.2.5 Balancing Reservoir**1.2.5.1 Civil Works**

Supply of Materials and construction of:

- a) Site clearing, grubbing and top soil removal;
- b) Cut to fill excavation and import fill material from borrow pit for the earth embankment dam construction;
- c) HDPE lining of the Balancing Reservoir compartments;

PART C3.1 - SPECIFICATION

- d) Inlet manifold pipe work and connection with desilting works;
- e) Outlet manifold and suction pipe to High-Lift Pumping Station;
- f) Concrete inlet, outlet and overflow structures;
- g) Miscellaneous steelwork including manhole covers, open grid flooring, hand railing, access ladders, etc.;
- h) Reinforced concrete valve, air, scour and flow meter chambers including all valves and flow meters;
- i) Security fence;
- j) Rehabilitation of soil surfaces; and
- k) Opening, development, management and closing / rehabilitation of borrow pits areas.

1.2.5.2 Electrical, Control and Instrumentation Works

Design, documentation, Drawings, supply and installation of:

- a) Power supply and cabling;
- b) Medium voltage and low voltage cable reticulation;
- c) Miniature substations;
- d) Earthing and lightning protection;
- e) Lighting and small power;
- f) Instrumentation cabling;
- g) Fibre optic network; and
- h) Control and Instrumentation.

1.2.6 High-Lift Pumping Station

This area is defined as a National Key Point (NKP) and shall comply with the requirements in the National Water Act, 1998 (Act No. 36 of 1998) and the Manual on Physical Security Measures at Departmental Works and Schemes.

1.2.6.1 Civil Works

Supply of Materials and construction of:

- a) Site clearing, grubbing, top soil removal and excavation;
- b) Cut to fill excavation and import fill material from borrow pit for platforms and backfill;
- c) Reinforced concrete pump well;
- d) Loading bay / platform;
- e) Local control room;
- f) Superstructure comprising reinforced concrete walls, face brick walls, reinforced concrete roof slabs, structural steel roof with IBR metal sheeting including all building services (water, sewerage and stormwater);
- g) Reinforced concrete valve, air, scour and flow meter chambers including all valves and flow meters;

PART C3.1 - SPECIFICATION

- h) Miscellaneous steelwork including crawl beam, crawl, block and tackle, manhole covers, open grid flooring, hand railing, access ladders etc.;
- i) Ancillary buildings (Security Room, Central Operation and Control Centre, etc.);
- j) Site works including access roads, stormwater drains, water supply, sanitation and security fences;
- k) Concrete block paved roads and parking; and
- l) Gravel surfaced access roads.

1.2.6.2 Mechanical Works

Design, documentation, Drawings, supply and installation of:

- a) Horizontal split-casing centrifugal low lift pumps complete with motors;
- b) Overhead crane;
- c) Actuated suction and delivery isolating butterfly valves for each pump line;
- d) Pipe work, specials, reducers, flanges and fasteners associated with all pump lines;
- e) Seal pumps complete with associated valves and pipe work;
- f) Oil separator for sump pit;
- g) Sump pumps with associated valves and pipe work;
- h) Water Treatment Plant; and
- i) Ventilation systems and split unit air conditioning systems.

1.2.6.3 Electrical, Control and Instrumentation Works

Design, documentation, Drawings, supply and installation of:

- a) Medium voltage switchgear;
- b) Medium voltage protection;
- c) Metering;
- d) Medium voltage cable reticulation;
- e) Low voltage cable reticulation;
- f) Distribution transformers;
- g) Miniature substations;
- h) Ring main units (RMU);
- i) Low voltage cabling;
- j) Low voltage switchboards and motor control centres (MCC);
- k) Standby generators;
- l) Uninterruptible power supplies (UPS);
- m) Battery and battery chargers;
- n) Medium voltage variable speed drives;
- o) Medium voltage power factor correction;

PART C3.1 - SPECIFICATION

- p) Motor surge protection;
- q) Earthing and lightning protection;
- r) Fire detection, protection, gas suppression and smoke ventilation system;
- s) Lighting and small power;
- t) Area lighting;
- u) Control and instrumentation;
- v) Access Control Biometric Systems;
- w) CCTV Systems;
- x) Instrumentation cabling;
- y) Programmable Logic Controllers (PLC);
- z) Managed Network Switches with Cabinets;
- aa) Supervisory Control and Data Acquisition (SCADA);
- ab) Microwave Radio Network (Mast Tower and Microwave Broadband Radio); and
- ac) Fibre optic network.

1.2.7 High-Lift Rising Main

1.2.7.1 Civil Works

Supply of Materials and construction of:

- a) Temporary fencing of the pipeline construction servitude;
- b) Site and pipeline route search and rescue activities, clearing and grubbing;
- c) Relocation of existing services;
- d) Removal and stockpiling of topsoil;
- e) Removal and stockpiling of fertile soil;
- f) Trench excavations in servitude;
- g) Drilling and blasting of hard material;
- h) Opening, development, management and closing / rehabilitation of borrow pits and spoil areas;
- i) Importing of suitable pipeline bedding and backfill material;
- j) Steel pipe manufacture and delivery to site;
- k) Construction of 1400DN rising main welded steel pipeline (27.2km);
- l) Manufacture, supply, delivery and installation of pipe specials;
- m) Supply, delivery and installation of isolating, non-return, control, scour and air valve installations;
- n) Supply, delivery and installation of pipeline ancillaries (such as pipeline markers);
- o) Supply, delivery and installation of flow meters;
- p) Construction of chambers;
- q) Construction of stream and wet land crossings;

PART C3.1 - SPECIFICATION

- r) Trench backfilling and the disposal of unsuitable or surplus excavation materials;
- s) Supply, delivery and installation of armoured fibre optic cable;
- t) Connecting to existing pipe work at take-off locations;
- u) Interface and connections with pipework at other Parts;
- v) Concrete Break Pressure Tank (BPT); and
- w) Construction of 1400DN gravity main welded steel pipeline (2 km); and
- x) Road crossings including pipe jacking and concrete encasement.

1.2.7.2 Electrical, Control and Instrumentation Works

Design, documentation, Drawings, supply and installation of:

- a) Power supply and cabling;
- b) Instrumentation huts / buildings at BPT;
- c) Area lighting;
- d) Earthing and lightning protection; and
- e) Fibre optic cable.

1.2.7.3 AC Mitigation and Cathodic Protection

Supply of Materials and construction of:

- a) AC Mitigation system installation; and
- b) CP system installation.

1.2.8 Break Pressure Reservoir**1.2.8.1 Civil Works**

Supply of Materials and construction of:

- a) Temporary fencing of the construction servitude;
- b) Site search and rescue activities, clearing and grubbing;
- c) Topsoil removal and stockpiling;
- d) Fertile soil removal and stockpiling;
- e) Cut and fill excavation and earth embankment construction;
- f) HDPE lining of the reservoir compartments;
- g) Inlet manifold pipe work;
- h) Outlet manifold;
- i) Concrete inlet and outlet structures;
- j) Overflow spillway construction;
- k) Miscellaneous steelwork including manhole covers, open grid flooring, hand railing, access ladders, etc.;

PART C3.1 - SPECIFICATION

- l) Reinforced concrete isolating, air, scour and flow meter chambers including all valves and flow meters;
- m) Ancillary buildings;
- n) Site works including access road and security fence; and
- o) Gravel surfaced road.

1.2.8.2 Mechanical Works

No mechanical design is required under this Contract. The mechanical Plant required is specified as part of the Employer's design Specifications and Drawings under the civil Works.

1.2.8.3 Electrical, Control and Instrumentation Works

Design, documentation, Drawings, supply and installation of:

- a) Power supply and low voltage cabling;
- b) Earthing and lightning protection; and
- c) Lighting and small power.

1.2.9 Gravity Main**1.2.9.1 Civil Works**

Supply of Materials and construction of:

- a) Temporary fencing of the pipeline construction servitude;
- b) Site and pipeline route search and rescue activities, clearing and grubbing;
- c) Site and pipeline route clearing and grubbing;
- d) Relocation of existing services;
- e) Removal and stockpiling of topsoil;
- f) Removal and stockpiling of fertile soil;
- g) Trench excavations in servitude;
- h) Drilling and blasting of hard material;
- i) Opening, development, management and closing / rehabilitation of borrow pits and spoil areas;
- j) Importing of suitable pipeline bedding and backfill material;
- k) Steel pipe manufacture;
- l) Construction of the following welded steel pipelines;
 - i) Part H1:
 - 1600DN (33 km)
 - 1500DN (30.5 km)
 - 1400DN (18.5 km)

PART C3.1 - SPECIFICATION

- ii) Part H2:
 - 1100DN (13 km)
- iii) Part H3:
 - 900DN (6.3 km)
- m) Manufacture, supply, delivery and installation of pipe specials;
- n) Supply, delivery and installation of isolating, non-return, control, scour and air valve installations;
- o) Supply, delivery and installation of pipeline ancillaries (such as pipeline markers);
- p) Supply, delivery and installation of flow meters;
- q) Construction of chambers;
- r) Construction of crossings at streams and wet areas;
- s) Trench backfilling and the disposal of unsuitable or surplus excavation materials;
- t) Supply, delivery and installation of armoured fibre optic cable;
- u) Interface and connections with pipework at other Parts;
- v) Connecting to existing pipe work at Off-Takes / Points of Supply; and
- w) Road crossings including pipe jacking and concrete encasement.

1.2.9.2 Electrical, Control and Instrumentation Works

Design, documentation, Drawings, supply, and installation of:

- a) Power supply and cabling;
- b) Instrumentation huts / buildings at Points of Supply;
- c) Area lighting;
- d) Earthing and lightning protection; and
- e) Fibre optic cable.

1.2.9.3 AC Mitigation and Cathodic Protection

- a) AC Mitigation system installation; and
- b) CP System installation.

1.2.10 Other Control and Instrumentation Works

Along the High-Lift Rising Main pipeline corridor, Break Pressure Reservoir, Gravity Main pipeline corridor and Off-Takes, the design, documentation, Drawings, supply, delivery and installation of:

- a) Control and instrumentation;
- b) Instrumentation cabling;
- c) Programmable Logic Controllers (PLC);
- d) Managed Network Switches with Cabinets;
- e) Supervisory Control and Data Acquisition (SCADA);

- f) Microwave Radio Network (Mast Towers and Microwave Broadband Radios); and
- g) Fibre optic network.

1.2.11 Other Electrical Work

In general, electrical reticulation shall be provided for pumps, cranes, large diameter valve actuators, lighting and small power for the Vlieëpoort (Low-Lift) and Mooivalei (High-Lift) Pumping Station buildings, area lighting, security, surveillance and instrumentation installations.

High voltage power distribution will be from Eskom overhead lines to a 2 x 20 MVA 132/11 kV Eskom substation at Mooivalei. Permanent power supply to the High-Lift Pumping Station is from the Eskom sub-station 11 kV switchboard (supply point) located on Mooivalei. This will be a firm supply with two incoming lines for full redundancy. The Contractor shall be responsible to transform the 11 kV power supply down to 400 V for normal small power and lighting, as follows:

- a) Mooivalei:
 - Medium Voltage – Pumping Station – 11 000 V, 3 phase, 3 wire, 50 Hz;
 - Low Voltage – 400 V, 3 phase, 4 wire, 50 Hz; and
 - Single Phase – 230 V, 2 wire, 50 Hz.
- b) Vlieëpoort:
 - Medium Voltage – Pumping Station – 11 000 V, 3 phase, 3 wire, 50 Hz;
 - Low Voltage – 400 V, 3 phase, 4 wire, 50 Hz; and
 - Single Phase – 230 V, 2 wire, 50 Hz.

The supply of Materials and the construction of the Eskom Substation platform is to be done under this Contract.

Along the High-Lift Rising Main pipeline corridor, Break Pressure Reservoir, Gravity Main pipeline corridor and Off-Takes, the design, documentation, Drawings, manufacture, supply, delivery and installation of:

- a) Uninterruptible power supplies (UPS);
- b) Battery and battery chargers;
- c) Earthing and lightning protection;
- d) Lighting and small power; and
- e) Power supply from the Eskom supply point to the Instrumentation Huts.

1.2.12 General Work

- a) Installation of temporary and permanent fencing;
- b) Installation of non-lethal electrical security fencing;
- c) New roads and upgrading of existing roads, maintenance of new and existing roads up to the issue of the Taking-Over Certificate, required for construction (Temporary Works) and the Permanent Works, including all associated works such as stormwater, excluding Local Municipality Roads, Provincial Roads and National Roads (covered in Clause 1.2.16);

PART C3.1 - SPECIFICATION

- d) Ancillary Works such as top soiling, landscaping, rehabilitation, storm water and erosion control and minor concrete works;
- e) Erection of facilities for the Engineer;
- f) Erection of facilities for the Contractor;
- g) Liaison with other TCTA Contractors, Eskom, Telkom, Transnet, SANRAL, RAL and other authorities;
- h) Provision of "as-built Drawings";
- i) Provision of Operating and Maintenance Manuals for all the components of the Works;
- j) Training of the Employers operators and maintenance personnel;
- k) Remedying of Defects in the Works;
- l) Commissioning for the following categories: Ready for Beneficial Operation (RFBO) (if applicable), Ready for Commissioning (RFC), Ready for Trial Operation (RFTO) and Ready for Operation (RFO);
- m) Acceptance Testing consisting of conducting the integrated commissioning, testing and hand-over to the Employer of the whole of the Works; and
- n) Maintenance and servicing the Works during the Defects Liability Period.

1.2.13 General Obligations

Fulfilment of other general and specific contractual obligations, inter alia in respect of such matters as programming, cash flow estimates, progress reports, construction and quality control, health and safety, industrial relations, socio-economic objectives, environmental management and the like as also indicated in the Conditions of Contract: Data Provided by the Employer.

In a number instances approval, consent, acceptance, agreement, review, etc., is required from the Engineer. Such instances include but are not limited to, for example, Method Statements, layouts, service providers and/or Subcontractors and the like. Any approval, consent, acceptance, agreement, review, etc., by the Engineer shall not relieve the Contractor from any obligations or responsibilities under the Contract.

1.2.14 Operation and Maintenance of Facilities

The operation and maintenance of certain facilities comprising inter alia the following:

- a) Potable water, sewerage, sewage and solid waste management and electrical works in and around the Site and at designated Site offices;
- b) Facilities provided for the Engineer and Employer; and
- c) Facilities provided primarily for use by the Contractor.

1.2.15 Ancillary Infrastructure

Supply of Materials and construction of Ancillary Infrastructure by a local sub-contractor. Ancillary Infrastructure will be constructed in two areas.

In the area directly east of the High Lift Pumping Station National Key Point area, an office building, store building, workshop and strategic store building, diesel storage area, 6 x 3-bedroom houses, 3 x 1-bedroom flats, a guest house and 6 x carports will be constructed.

PART C3.1 - SPECIFICATION

Approximately 2.5 km east of the High Lift Pumping Station, on the eastern side of Road D1649, 38 x 3-bedroom houses and a community hall will be constructed.

All services associated with the Ancillary Infrastructure (roads, storm water, water reticulation, sewerage, electricity reticulation and infrastructure, security fencing etc. will be constructed. Water and sewage treatment facilities associated with the Ancillary Infrastructure will also be constructed.

A Provisional Sum is provided in the BoQ for the executed by the Contractor of this work.

1.2.16 Upgrading and maintenance of existing roads during construction

Existing gravel and surfaced roads will require upgrading and maintenance work during the execution of the Works. The extent and timing of the required upgrading and maintenance work will be determined in consultation with stakeholders and may include crack sealing, repair of potholes, resurfacing, intersection improvements, edge break repairs, gravel shoulder repairs, cutting of grass in road reserves and road markings.

A Provisional Sum is provided in the BoQ for the execution of this work by the Contractor. This Provisional Sum only covers the upgrading and maintenance of Local Municipality Roads, Provincial Roads and National Roads and it excludes the work covered in Clause 1.2.12.

1.3 THE SITE

1.3.1 Location of the Site

The construction of the water transfer infrastructure is located between Thabazimbi and Lephalale in the Limpopo Province of the Republic of South Africa. Access to the Site is possible by road. The distance by road (R510) between Thabazimbi and Lephalale is approximately 132 km. The distance by road between Thabazimbi and Pretoria is approximately 212 km.

The construction work required under this Contract will be taking place between Vlieëpoort, the farm Mooivalei near Thabazimbi and the Points of Supply to Medupi and Matimba Power Stations. Vlieëpoort and the farm Mooivalei is located approximately 15 km West of Thabazimbi town centre.

Access to the Site is possible by road. Access to the extended construction Site will be via the surfaced R510 National road and D1649 Provincial road and gravel access roads. Refer to the Drawing No 2A-C3-001 depicting the locality plan.

1.3.2 Climatic Data

The project area covers an extent from Thabazimbi to Lephalale in the Limpopo province and climatic data is available on the South African Weather Service website (www.weathersa.co.za).

Site-specific hydrological data is contained in Part C4.3 - Hydrological Data.

The Vlieëpoort Site located in a natural hydraulic control (narrow cross section) in the Crocodile (West) River. Dry weather flooding is possible due to the size of the catchment upstream of Vlieëpoort.

1.3.3 Geotechnical Data

Geotechnical investigations of the various areas of the project have been undertaken also covering the borrow pit areas.

Full details of the geotechnical investigations, the construction materials and results of laboratory tests, rotary core drilling and test pits are contained in Part C4.2 - Geotechnical Data.

The Weir structure, Diversion Works and Low-Lift Pumping Station at the Vlieëpoort Site are to be founded on a combination of deep alluvial and boulder matrix. The complicated nature of the founding conditions will require further confirmation geotechnical work by the Contractor during construction and continuous monitoring of penetration rates during the jet grouting process.

A Provisional Sum is provided for more geotechnical drilling and testing during construction.

It is foreseen that the patented Wassara jet grouting hammer or similar approved technology will be required to penetrate the boulder matrix at an acceptable production rate.

1.3.4 Access to the Site: General

Access to the project area is possible via several gravel farm access roads, National and Provincial roads (as generally described in Clause 1.3.1).

Currently access to the pumping station areas and most other sections of the pipeline route is generally feasible by 2-wheel drive vehicles. Access for normal heavy vehicles may be difficult in places when it is wet.

1.4 USE OF THE SITE

1.4.1 Definitions and Use of the Site

The Site includes the areas of the construction servitude along the pipeline routes, pumping stations and reservoirs as indicated on the Drawings. Included in this is the full extent of all borrow pits, spoil areas and access roads designated as such in the Contract.

Specific areas of the Site are designated as follows:

- a) The working areas required for construction, borrowing of construction materials and spoiling of excess or unsuitable material, including haul and temporary access roads; and
- b) The establishment areas required by the Contractor for the establishment of primary and secondary facilities such as batching Plant, screening Plant (if necessary), workshops, storage, Plant and equipment, explosives magazines, fuel depots and other sensitive facilities, offices and other facilities required by the Contractor in undertaking the Contract.

The designated areas shall be surrounded by boundary fencing as specified in Section 6 - Fencing which shall be erected by the Contractor prior to commencing any other operation or work and maintained by him for the duration of the Contract. The Contractor will not be permitted to work or perform any operation prior to completion of such fencing and will not be allowed to continue with operations should the fencing be damaged or fall into disrepair, until the fencing has been repaired.

PART C3.1 - SPECIFICATION

Other areas of the Site not specifically defined but which the Contractor may require for the location of other facilities shall be subject to the prior approval of the Engineer regarding extent, access, programme and layout. Refer to Section 4 – Environmental Management for requirements regarding special “no go” areas and appropriate signage and fencing to be erected.

The Contractor shall not use the Site for any purpose other than that of executing the Works or for any purpose other than as designated under the Contract and shall confine his operations to within these areas unless otherwise approved in writing by the Engineer.

Should the Contractor require any additional areas, he shall first notify the Employer, via the Engineer of the areas required. Thereafter, in close liaison with the Employer, the Contractor shall be responsible for arranging all necessary approvals with the relevant Authorities (including the payment of any fees associated therewith) and shall provide the Engineer with copies of such approvals before establishing in the additional areas.

1.4.2 Legislative Requirements

The Contractor shall arrange for and comply with all current legislation and its regulations that are relevant to the Temporary Works and Permanent Works and use thereof. Such may be classified use of land, erection and use of facilities such as explosive magazines, disposal of waste, and others.

1.4.3 Security of the Site

The Site shall be subject to the security requirements of Clause 1.8.3.14.

1.4.4 Property outside the Site

The Contractor shall not enter upon land outside the Site, without written approval from the Engineer.

1.4.5 Ownership of Natural Materials

Earth, stone, gravel, sand and all other materials excavated or existing on the Site shall not become the property of the Contractor, but will be at his disposal only in so far as they are required for use in the Works and approved as such by the Engineer.

1.4.6 Ownership of Existing Structures and Equipment

All existing structures or equipment on the Site that are to be demolished and/or removed in terms of the Contract shall become the property of the Contractor unless otherwise indicated by the Engineer. All other existing structures, services or related ancillary structures on the Site, insofar as they may be the property of private landowners or others or the Employer, shall remain the property of those landowners or others or the Employer and, except as and to the extent required elsewhere in the Contract, shall not be interfered with by the Contractor in any way.

1.4.7 Existing Rights of Way

Any existing rights of way or roads running through the Site shall, on instruction from the Engineer, be diverted around the Site or fenced off in such a way as to prevent unauthorised persons from

inadvertently entering the Site. Such rights of way or roads shall be kept open at all times except for short periods when construction activities such as surface blasting could require closure for safety reasons.

Where arrangements need to be made to allow essential continued access for local residents these will be subject to agreement by the Engineer.

In all areas where construction activities impact on the existing rights of way the Contractor shall ensure that appropriate machinery to create emergency access through or round the Site is available. The Contractor's charges for such shall be deemed to be included in the rates and prices in the Bill of Quantities.

1.4.8 Construction Establishment Areas

The Contractor shall prepare a site establishment plan for the approval of the Engineer prior to establishment on Site. This plan shall identify construction activities, facilities and structures in relation to sensitive environmental features. This plan will serve as a spatial tool that facilitates the execution of the construction phase with due consideration of sensitive environmental features. This planning process shall include the following:

- a) Conduct a pre-construction survey (walk down) of the area to be affected by the planned construction activities. This must include site investigations with photographic records.
- b) Suitable specialist(s) shall propose measures to limit the impact on sensitive environmental features (including fauna, flora, watercourses and heritage sites) where special care needs to be taken, and implement the required suitable mitigation measures to safeguard these features (e.g. barricading, signage and awareness creation). Refer to the findings of the EIA specialist and baseline studies, Construction Environmental Management Programme (CEMP_r) and Section 4 – Environmental Management.
- c) A suitable specialist is to identify protected plants and trees. Any protected plants or trees in proximity to the construction domain that will remain, should be marked clearly (danger tape, fencing, etc.) and must not be disturbed, defaced, destroyed or removed, unless otherwise specified by the Engineer. If avoidance of protected trees is not possible, the Contractor shall acquire the necessary permits under the NFA and other applicable Provincial Legislation.

The planning process shall also take the following aspects into account:

- a) Locate construction camps in areas where sensitive environmental features will not be impacted on.
- b) Facilities and structures shall be located with due cognisance of the terrain and geographical features of the project site.
- c) Positioning of the storage and lay-down areas should aim to minimise visual impacts.
- d) Maintain barricading around sensitive environmental features until the cessation of construction works.
- e) Control the movement of all vehicles and plant (including suppliers), such that they remain on designated routes and comply with relevant agreements.
- f) Ensure noise levels of construction activities and equipment are within their lawfully acceptable limits as per SANS 10103.
- g) Minimise public disturbance from lighting of the construction camp and site. For example, proper design of the placing (zones), height, type, direction (inward rather than outward) and intensity of floodlights, without compromising safety.

PART C3.1 - SPECIFICATION

The Contractor shall establish Site in accordance with the above plan approved by the Engineer.

The Employer will not provide any services at these locations and will not be responsible for the availability or non-availability of additional establishment areas nor for facilities at any establishment areas. It is the Contractor responsibility to ensure any establishment area complies with all the relevant legislation, ordinances, and bylaws.

If any trees need to be transplanted to facilitate the creation of Contractor establishment areas, this shall be done in accordance with the Engineer's instruction and the requirements stated in Section 47 – Landscaping and Rehabilitation.

When no longer required, the Contractor shall rehabilitate the relevant area in accordance with the requirements of Section 47 – Landscaping and Rehabilitation.

The areas identified by the Employer for construction establishment are described below.

1.4.8.1 Mooivalei

The Employer has designated the area, which is located adjacent to the location of the proposed High-Lift Pumping Station as a possible construction establishment area. Access is available from the District Road D1649. Limited services are available as stated in Clauses 1.6.3 to 1.6.7.

1.4.8.2 Vlieëpoort

This area has been identified as a potential location for a construction storage / laydown / parking area only. The area is virgin veld, privately owned. Access is possible from an existing private road from District Road D1649.

1.4.8.3 Other Establishment Areas

Refer to the locality plan indicating the position and access of other potential establishment areas as provided for in the Final Development Layout Plan.

1.5 FACILITIES

Various facilities and infrastructure are to be provided and/or managed and operated and/or maintained in terms of the Contract. The provision of facilities is divided into three categories as follows:

- a) Those to be provided by the Employer or others (Clause 1.6);
- b) Those to be provided by the Contractor for the Engineer (Clause 1.7); and
- c) Those to be provided by the Contractor for the Works (Clause 1.8).

1.6 FACILITIES PROVIDED BY THE EMPLOYER OR OTHERS

1.6.1 General

The facilities specified in the following clauses will be provided by the Employer or by others on behalf of the Employer. Such facilities will be completed either prior to the Commencement Date or during the early part of the Contract.

PART C3.1 - SPECIFICATION

The Employer will only provide limited facilities. The Employer will not provide interim and long-term facilities but the Contractor shall provide such facilities as stated in Clauses 1.7 and 1.8.

The Contractor shall be fully responsible for extending, expanding or upgrading any facility provided by the Employer as the Contractor may consider necessary, subject to the Engineer's consent, including any additional maintenance that this may require. This responsibility shall include liaison with the relevant authorities and bearing all the respective charges without additional payment.

If a facility is provided, maintained and operated by the Employer or by others on behalf of the Employer, and made available to the Contractor, the charges for the use of such facilities shall be as stated in Clause 1.15.

In all cases, the Contractor shall take all necessary precautions to ensure that the facilities are used in a proper, controlled and orderly fashion and that resources supplied are not wasted.

Should the Contractor require additional services or facilities, he shall be responsible for identifying them and preparing the necessary applications in the same manner as for those identified by the Employer.

The Contractor shall be responsible for any charges raised by the relevant authorities for services or facilities and for all equipment required to deliver services and facilities to the various construction sites.

The Contractor shall be responsible for any licenses, approvals and the like required by relevant authorities for the use of any infrastructure or services during construction.

Apart from facilities provided by the Employer, the Contractor shall be responsible for all other facilities and infrastructure that he may require.

1.6.2 Construction Establishment Areas

The Employer has identified areas for construction establishments as stated in Clause 1.4.8.

1.6.3 Electrical Power

The Employer will not provide electrical power for construction.

1.6.4 Water for Construction

The Employer will not provide water for construction.

1.6.5 Potable Water

The Employer will not provide potable water on the Site.

1.6.6 Sewerage and Sewage Treatment

The Employer will not provide sanitation services and the Contractor shall be responsible for making, throughout the Site, his own arrangements for the collection, treatment and disposal of sewage.

1.6.7 Communication

The Employer will not provide any communication services and the Contractor shall be responsible for making his own arrangements for communication throughout the Contract period as necessary.

1.6.8 Borrow and Spoil Areas

Borrow pits and spoil areas have been identified by the Employer and are shown on the Drawings provided in **Part C4.2 - Geotechnical Data**. No royalty charges or the like will be levied against the Contractor for construction materials obtained from these borrow pits or for material spoiled in the designated areas. Access servitudes to borrow pits and spoil areas have been defined, as far as possible, along existing access roads. The Contractor shall be responsible for maintenance and rehabilitation of these roads and to construct new access roads for all exceptions.

Should the Contractor utilise additional borrow or spoil areas, or make use of commercial sources, he shall make all arrangements necessary and shall be responsible for any costs or charges associated therewith. The Contractor shall be responsible for arranging his own access and the routes of all such additional access and sources shall be subject to prior written approval by the Engineer.

All borrow and spoil areas as well as the access roads to these areas shall be constructed, operated and rehabilitated as specified in Section 4 – Environmental Management and Section 47 – Landscaping and Rehabilitation.

1.7 FACILITIES TO BE PROVIDED BY THE CONTRACTOR FOR THE ENGINEER AND THE EMPLOYER (ENGINEER'S FACILITIES)

1.7.1 General

The Contractor shall provide, erect and maintain the interim and long-term facilities within the periods as specified for the sole use of the Engineer, provided that the Employer, may utilise any of these facilities without relieving the Contractor of any of his obligations under the Contract.

Should the Contractor elect to open additional work fronts, he shall provide the number of serviced facilities per front as stated below. The Contractor's charges for these facilities will be deemed included in the rates and prices in the Bill of Quantities. This requirement is not applicable to moving work fronts on the pipelines.

The Contractor shall dismantle and remove from the Site all facilities provided under this Clause and Clause 1.8 which are no longer required, as agreed by the Engineer, and shall rehabilitate all affected areas in accordance with Section 47 - Landscaping and Rehabilitation.

The Contractor shall provide, maintain and service the offices described below at the area designated in the Contractor's Site establishments for use by the Engineer.

PART C3.1 - SPECIFICATION

**TABLE 1/1
OFFICE ACCOMMODATION REQUIREMENTS**

Interim Facilities:

Description	No. (Engineer)	No. (Employer)	Dimensions m	Total Area (m ²)
Offices (Medium)	5	2	4x4	112
Open plan (Medium)	2	2	6x8	192
Spare Office	1	1	3x3	18
<u>Toilets:</u>				
Male (2 No. Urinals, 2 No. Toilets, 3 No. Hand wash basins)	1	1	4x4	32
Female (2 No. Toilets, 3 No. Hand wash basin)	1	1	4x4	32
Total Area				386

Long-Term facilities at the main construction establishment area (Project Office):

Description	No. (Engineer)	No. (Employer)	Dimensions m	Total Area (m ²)
Office (Large)	3	8	4x4	176
Office (Medium)	22	-	3x4	264
Open plan (Medium)	18	2	4x6	480
Open plan (Large)	3	2	6x8	240
Filing Room (fire proof)	2	1	5x3	45
Kitchen	2	2	4x3	48
Storeroom	2	1	5x3	45
Print Room	2	1	5x3	45
Conference Room (Large)	2	-	5x15	150
Conference Room (Medium)	-	2	5x12	120
Server and UPS room	1	1	3x4	24
Wellness Room	1	2	3x3	27
<u>Toilets:</u>				
Male (2 No. Urinals, 2 No. Toilets, 3 No. Wash basins)	2	2	4x4	64
Female (2 No. Toilets, 3 No. Wash basin)	2	2	4x4	64
Total Area				1792

PART C3.1 - SPECIFICATION

Long-Term facilities at each work front:

Description	No. (Engineer)	No. (Employer)	Dimensions m	Total Area (m ²)
Office (Medium)	3	2	3x4	60
Kitchen	1	1	3x4	24
<u>Toilets:</u>				
Male (1 No. Urinals, 1 No. Toilets, 1 No. Wash basins)	1	1	3x4	24
Female (1 No. Toilets, 1 No. Wash basin)	1	1	3x4	24
Total Area				132

Based on the assumption that the Project Office will be located at the High Lift Pumping Station area, the Contractor shall provide long-term work front office facilities for the Engineer for at least one (1) position along the Gravity Main, at a location agreed with the Engineer. No office facilities for the Engineer are required at the moving pipeline work fronts.

The office facilities for the Engineer and the Employer shall be provided separate and adjacent to each other.

The Contractor shall be deemed to have allowed in his rates and prices in the Bill of Quantities for serviced office accommodation as indicated in the table above.

The Contractor shall provide and maintain office and related facilities to the following standards:

(a) Building Standards

The buildings for the Engineer shall be single story, weatherproof, rodent- and termite-proof, dust proof and burglar proof. Burglar proofing shall at a minimum include burglar bars in front of all opening windows as well as fixed panes. Buildings shall be constructed of treated timber, fibre-cement, brick, concrete block or other durable materials as approved by the Engineer. Prefabricated buildings shall have double walls filled with insulating material and lined on the inside with material as approved by the Engineer. External walls of brick or concrete block shall be of cavity construction. All walls shall have a fire rating of at least 60 minutes and maximum thermal conductivity of 2.1 W/m².°C.

Thermally insulated ceilings (insulation 70 mm thick glass fibre matt or similar approved, total maximum conductivity of 0.6 W/m².°C) shall be provided throughout and the floor shall be damp-proofed concrete raised at least 225 mm above the highest adjacent external ground level.

The floors of brick office buildings, including the entrance hall, store rooms, change rooms, kitchens and ablution facilities shall at a minimum be smooth float finished screed with PVC tiles. The minimum clear height between floor and ceiling shall be 2.4 m.

The document storage and server rooms and doors shall have a fire rating of 240 minutes and be burglar proof as described above. The plan printing / photocopier and UPS rooms shall each be fitted with extractor devices to remove noxious fumes.

One wall of the kitchen is to be equipped with upper and lower cabinetwork including a double bowl / double drain board stainless steel sink supplied from a 20-litre geyser.

PART C3.1 - SPECIFICATION

Each building shall have fully glazed windows each at least 30% opening for ventilation. Total window area for each room shall be at least 20% of floor area.

Each room / office shall be capable of being locked with two keys supplied for each lock.

Roofing to all buildings shall be hail-proof, at a minimum pitch of 15°.

(b) Air Conditioning

Each room / office except the kitchen shall be provided with a reverse-cycle air conditioner so that a temperature range of 21-23°C can be maintained throughout. In addition to the above, a minimum of one reverse-cycle air conditioner per 15 m² or part thereof shall be provided for larger rooms.

(c) Building Services Standards

Hot (55°C) and cold running water (potable standard) shall be provided to the kitchen and cold running water only to toilet facilities. Hot water pipes shall be lagged or otherwise suitably insulated.

Sewage shall be water-borne with flush toilets and waste water system piped to an on-site treatment facility as described in Clause 1.8.3.6.

The electrical system shall comprise a 60 A three phase 380/220 V 50 Hz supply which shall be connected to a mains isolator in the building's distribution board.

Circuit breakers of adequate rating shall be provided for the following circuits in the non-essential supply side of the distribution board:

- Lighting; and
- Switched socket outlets connected to 30 mA earth leakage units.

On the essential supply side of the distribution board (15 kVA uninterruptable power supply), 10 A single pole circuit breakers shall be provided for every two computer switched socket outlets.

Each office shall be provided with three switched socket outlet units. Two switched socket outlet units shall be fed from the non-essential supply and the other from the essential supply side of the distribution board. The essential supply socket outlet units shall have a flat side on the earth pin socket to prevent appliances other than computers from being connected to the uninterruptable power supply. Open plan office areas and the boardroom / conference room shall be equipped with four switched socket outlet units (two from the non-essential supply and the other two from the essential supply) per 10 m².

Adequate lighting (in the opinion of the Engineer) shall be provided. External lighting shall be sufficient to provide adequate (in the opinion of the engineer) lighting between offices and carparks. This lighting shall be switched by photo electric cell or similar approved.

The Contractor shall provide a fully functional and working computer network, including all networking equipment like switches and routers (Industrial type, fanless) as well as networking software, cabling (Cat 5e or 6 – UTP or STP) and connections (RJ45) to the following requirements:

- One working internal office telephone and two working internet / e-mail data connection points each per office;

PART C3.1 - SPECIFICATION

- One working internal office telephone and one working internet / e-mail data connection point each for reception offices;
- Two working internet / e-mail data connection point each per conference room; and
- Two internet / e-mail data connection point for each 10 m² open plan office area.

All power, computer network cabling and telephone cabling shall be contained in accessible split trunking power skirting at floor level. Power cabling and the computer-and-telephone cabling shall be used separately.

The Contractor shall provide the necessary firefighting equipment and signage as per Clause 1.7.6.

1.7.2 Interim Facilities

1.7.2.1 General Requirements

Until such times as the Contractor has established the various long-term services and/or facilities for the Engineer, the Contractor shall provide and maintain such interim facilities for the Engineer as are necessary, together with any associated service or assistance as the Engineer may reasonably require.

Such interim facilities could be located in the construction establishment areas or in Thabazimbi and possession of the interim facilities will revert to the Contractor once the Engineer has taken possession of his long-term facilities. The Contractor shall take due cognisance of rationalising the interim facilities with respect to the timing and provision of the later long-term facilities.

The interim facilities shall be provided within 7 days of the Commencement Date and will be used for a maximum of 56 days from the Commencement Date, by which time the Engineer's long-term facilities shall be in place.

1.7.2.2 Offices and Other Facilities

The Contractor shall provide and maintain serviced interim Site offices, carports and security fencing. Before occupation, the interim facilities shall be secured to the security standards stated in Clause 1.7.7.

The interim facilities shall be as described in Table 1/1 in the form of temporary offices such as mobile offices or existing buildings that have been refurbished as office space.

The interim laboratories specified in Clause 1.8.2.2 shall be for the joint use of the Engineer and the Contractor under the same provisions as Clause 1.8.3.9.

1.7.2.3 Services

The Contractor's obligations regarding the provision of services to the Engineer's areas as specified in Clause 1.7.3 shall apply *mutatis mutandis* for the Engineer's interim facilities.

Appropriate communications (including voice) to the Engineer's interim facilities shall be provided by the Contractor as agreed with the Engineer.

The Contractor shall provide a temporary network that can accommodate at least hundred and twenty (120) computers and provide access to the internet and email facilities.

1.7.2.4 Assistance to the Engineer

The Contractor shall provide assistance to the Engineer as provided for in Clause 1.7.4.

1.7.3 Long-Term Facilities

1.7.3.1 General Requirements

The Engineer's main Site offices with related facilities and services shall be established at the same location as the Contractor's main Site offices. The Engineer will also require a Site office with related facilities and services at each of the Contractor's work fronts at the same location as the Contractor's Site offices. This requirement is not applicable to moving work fronts on the pipelines.

These Engineer's long-term facilities shall be available for occupation by the Engineer's staff within 56 days of the Commencement Date.

1.7.3.2 Outbuildings

Two outbuildings each of at least 30 m² plan area shall be provided, one as a store, general workshop and the other for handymen and the like within 20 m of the Engineer's area at the main construction establishment area. The workshop area shall be provided with a workbench to the Engineer's approval.

Sanitation facilities shall be provided as an additional area of at least 20 m² consisting of:

- a) Four (4) showers (hot and cold water);
- b) Four (4) wash hand basins (hot and cold water);
- c) Four (4) flushable urinals; and
- d) Four (4) flushable water closets.

1.7.3.3 Engineer's Access to Site Laboratories

The facilities required by the Engineer are to be incorporated with the Site laboratories at the construction establishment areas as specified in Clause 1.8.3.9. The Site laboratory shall be available for the Engineer on a shared basis.

1.7.3.4 Car Ports

Car ports for a total of eighty five (85) vehicles at the Engineer's main Site offices and eight (8) car ports at the additional construction establishment areas shall be constructed over parking areas so that the vehicles parked under them will at all times be protected against the direct rays of the sun and protected from hail.

The car ports shall each be at least 15 m² in area and the floors shall consist of a suitable layer of broken stone to alleviate dusty and muddy conditions. Each carport shall be at least 3 m wide and shall have headroom of at least 2 m. The roofs of all car ports shall be of zinc roof sheeting or as agreed with the Engineer. Carports shall be clearly numbered.

PART C3.1 - SPECIFICATION

The Contractor shall provide the covered carports adjacent to the offices detailed above and shall establish adequate security arrangements as required in Clauses 1.8.3.2 and 1.8.3.14, to the satisfaction of the Engineer, to guard against theft and vandalism.

The Contractor shall provide and maintain a paved vehicle wash bay complete with water connection and garden hose and fittings suitable for the purpose of washing vehicles at the main construction establishment. All wastewater from the wash bay shall be collected and disposed of in accordance with Section 8 – Dealing with Water.

1.7.3.5 Engineer's Facilities after Completion of the Works

Following the issuing of the Taking-Over Certificate (TOC) for the Works, the Contractor shall provide, maintain and service two (2) large offices (4 m x 4 m each) with related necessary facilities and services as stated in Clause 1.7, for the use of the Engineer while completing administrative tasks and to settle the final accounts.

The office will be required up to the later date of 3 months after the issuing of the TOC or 2 months after the last construction activity on Site, and in line with the instruction of the Engineer Items not to be provided by the Contractor.

The Contractor is not required to provide the following for the Engineer's facilities at the main office:

- a) Furniture (chairs, desks, etc.);
- b) Computers;
- c) Printers and printing consumables; and
- d) Vehicles for use by the Engineer.

All other equipment, stationery, consumables and the like required for the operation and maintenance of the Engineer's facilities shall be provided and maintained by the Contractor.

1.7.4 Assistants for the Engineer

The Contractor shall make available to the Engineer the assistants as detailed below:

- a) Three (3) drivers / messengers for general duties. The drivers shall speak, read and write English, shall each have at least 1 year applicable experience, and shall each possess a valid South African driver's license. One of the drivers shall be licensed to drive a minibus for transport of people;
- b) Four (4) survey assistants with at least three years applicable experience. They shall speak, read and write English fluently, shall each hold a valid South African driver's license, and shall be able to use a calculator proficiently;
- c) Three (3) junior laboratory technicians with at least 1 year applicable experience. They shall speak, read and write English fluently, shall each hold a valid South African driver's license, and shall be able to use the laboratory equipment proficiently;
- d) Four (4) full-time dedicated cleaners / tea persons at the main office and one (1) at each of the work front offices. This person shall adhere to principles of sound hygienic services and speak and read English; and
- e) Three (3) full-time dedicated general assistant to care for gardens, wash motor vehicles and perform other general duties that may be required.

PART C3.1 - SPECIFICATION

These assistants shall be screened, employed and paid by the Contractor and shall be provided from the Commencement Date until the date of the last Taking-Over Certificate and shall be available full time during office hours for the Engineer shall also assist the Engineer on other work concerned with MCWAP-2. Such assistants shall not be replaced without the approval of the Engineer. The Contractor shall provide an immediate replacement for any assistant who, in the sole discretion of the Engineer, is unsatisfactory.

1.7.5 Medical

The Contractor shall make all the first aid facilities established for his own staff continuously available to the Engineer's and Employer's staff and authorised visitors, provided that any such use shall conform to the normal controls and regulations that the Contractor applies to his own staff.

1.7.6 Fire Control

The Contractor's firefighting teams and equipment shall, without prejudice, be equally subject to call-out or instruction directly both by the Engineer as well as the Contractor whenever necessary.

Each building shall be supplied with fire extinguishers, which shall be of the BFC (bromochloro-fluoromethane) type manufactured to BS 1721 and suitable for Types A, B, C and E fires.

The extinguishers shall each contain not less than 2,5 kg of extinguishing fluid and shall be fitted to the walls at suitable positions by means of quick-release brackets. They shall be freshly charged, properly maintained and the seals shall be unbroken. At least one such extinguisher shall be provided per 50 m² of floor area or part thereof and at least one per building.

Fire control measures shall be adequate to cover all areas on Site and comply with the relevant statutory requirements.

1.7.7 Construction Establishment Fencing and Security

The Engineer's Site office areas shall be incorporated into the fenced area of the construction establishment area in accordance with Clause 1.8.3.1 and shall also be incorporated in the security system instituted and operated by the Contractor in accordance with Clause 1.8.3.14.

1.7.8 Sanitation and Cleaning

The provisions of Clause 1.8.3.13 regarding the Contractor's provision of sanitation and cleaning services shall apply mutatis mutandis to the Engineer's areas.

The Contractor shall further ensure that ablution and sanitation facilities are continuously and adequately supplied with soap, clean towels, toilet paper, etc.

The Contractor shall ensure that the wash bay facilities are adequately supplied with detergents, clean wash cloths, towels and a high pressure washer.

The Contractor shall remove twice weekly all refuse including disposal in accordance with Clause 1.8.3.13.

1.7.9 Electrical Power

Mains supply shall be through a 3-phase 4 wire 380/220 V 50 Hz LV cable distribution system with miniature substations, all in accordance with the general standards and specific requirements of Eskom, and to the approval of the Engineer.

The Contractor shall continuously provide, free of charge, such power to each building erected for the Engineer, by the date the offices are to be used.

The power available shall be adequate for the facilities but not be less than the following:

- Main office - 220 kVA
- Front offices - 15 kVA each

Suitable standby generating capacity shall be continuously available for immediate and automatic connection and supply in case of breakdown of the normal supply.

The Contractor shall be responsible for electrical power at the construction establishment areas.

This shall include:

- a) Applying for the temporary connection;
- b) Payment of all connection and consumption charges to the service provider;
- c) Supply and installation of all necessary protection equipment, circuit breakers and/or fuses; and
- d) Supply and installation of all the equipment required to reticulate temporary power at the required voltage (including all overhead lines, transformers, distribution boards, etc.).

The Contractor shall be required to provide a Certificate of Compliance to confirm that the connection complies with all legislation.

Up to Ready for Commissioning (RFC) status, any risk associated with electrical power outages will be the Contractor's risk, the effects of which shall be deemed to be covered in the Contractor's rates and prices in the Bill of Quantities and allowed for in his programmes.

After RFC status, electrical power will be supplied by the Employer from the permanent power connections. The Contractor shall consider and allow for power disruptions to Commissioning in his planning in accordance with the following conditions:

- a) All the Contractor's costs and delays resulting from standing time of his facilities, equipment and labour, etc., due to outages and consequences of such outages totalling up to 7 days shall be deemed to be included in the rates and prices in the Bill of Quantities and allowed for in his programmes.
- b) Outages of greater accumulated time will be considered for compensation and extension of time in accordance with the Contract, except for outages that do not cause delay to the Works and outages resulting from the Contractor's actions or omissions, whether intentional or otherwise.

1.7.10 Water Supply

The Contractor is required to drill new boreholes for the provision of water for construction and to the proposed infrastructure (High-Lift Pumping Station, Operation and Control Centre).

PART C3.1 - SPECIFICATION

The Contractor shall provide purification facilities for water intended for consumption by personnel. Such purified potable water shall comply with the requirements of SANS 241 – Drinking Water Standards.

The Contractor shall provide and maintain, free of charge and by the date the Site offices are to be occupied, a continuous supply of potable water as specified in Clause 1.8.3.5, sufficient to serve each of the Engineer's areas at a minimum pressure of 100 kPa under all operating conditions. The supply shall include all necessary storage tanks, mains, piping, valves, fittings, etc. Storage shall be adequate for the facilities but shall not be less than 30 m³ at the main offices and not be less than 5 m³ at each of the front offices.

1.7.11 Sewerage and Sewage Treatment

The Contractor shall provide and maintain, free of charge and by the date the offices are to be occupied, the collection, treatment and safe disposal of sewage from the Engineer's areas as specified in Clause 1.8.3.6.

In particular, the Contractor shall ensure that the peak loads do not surcharge the sewerage system or the sewage works.

Should a piped connection to the treatment facility prove to be impractical or a treatment facility is not provided at any of the areas, the Contractor shall lead all effluent to a conservancy tank or tanks of capacity as specified in Clause 1.8.3.6. If conservancy tanks are provided the Contractor shall arrange for the removal and disposal of the sewage at such regular intervals as to avoid surcharging of the tanks, but at least once per week.

Where needed, suitable arrangements shall be made with the relevant Local Authority.

1.7.12 Construction Establishment Access Roads

The Contractor's obligations regarding the provision of construction establishment access roads to the Contractor's facilities as specified in Clause 1.8.3.3(a) shall apply *mutatis mutandis* for the Engineer's facilities under Clause 1.7.3.

1.7.13 Communications

Cellular phone coverage is currently poor or non-existent on the Site and the Contractor shall be responsible to provide facilities to ensure voice communication everywhere on Site. Voice communication will have to be primarily by means of two-way radios.

The Contractor shall provide adequate facilities to ensure consistent and reliable communication between employees of the Contractor, the Employer and the Engineer over the complete Site.

A fixed satellite base station with adequate capacity shall be erected at the Contractor Camp sites to enable data communication via email and the internet.

The communication systems for the Engineer shall be provided by the same service providers used for the Contractor's senior employees communication systems and shall be by reputable service providers with a reliable service in the area. The communications shall be installed within 56 days from the Commencement Date.

The installation shall be arranged in the name of the Contractor who shall bear all charges (e.g. installation and monthly rental and call charges).

PART C3.1 - SPECIFICATION

1.7.13.1 VoIP (Voice over Internet Protocol) and Data Communications

The Contractor shall provide the following communication services to the Engineer's main Site offices:

- a) At least 20 VoIP handsets;
- b) Data / e-mail connections at the highest speed available over the satellite connection to the Site offices, conference room and reception office as per Clause 1.7.1;
- c) One VoIP switchboard installed in the main reception office;
- d) Adequate lightning and surge protection on the incoming telephone and data lines if a copper medium is used. The lightning and surge protection must be undertaken by a professional expert. The Contractor shall, within 7 days, replace any equipment damaged by any cause whatsoever and restore the system to working order; and
- e) VoIP handsets installed in each office as per Clause 1.7.13.1 and one installed in the conference room.

At least 4 VoIP handsets and data communications of a similar standard as described directly above shall be provided to the Engineer's Site offices at each Engineer's work front office.

1.7.13.2 Site Communications (Radio)

Voice communications for the Engineer within the complete Site shall be by means of two-way radios procured by the Contractor from an established service provider in the area. The service provider shall have a long and acceptable history with regards to voice networks in the general area of the Site and shall also have a sufficiently large network and installation base in that area. The Contractor shall ensure that the service provider provides full coverage at all Parts of the Works, including everywhere along the pipeline routes as well as between all other areas of the Site by undertaking communication checks along the pipeline routes and at each establishment area and submitting the results for acceptance by the Engineer.

The two-way radios supplied by the Contractor to the Engineer shall conform to the following minimum functionality:

Radio Facilities:	Call Facilities:	
32 available channels	Individual Call	Emergency Call
QT/DQT encode and decode	Conference Call	Status Message Call
DTMF encode	Broadcast Call	Short Data Message
Time-Out timer	Inter-fleet Call	Call Diversion
Name Tag	PABX Call	Don't disturb facility
Busy Channel Lockout	PSTN Call	Queue Incoming Call
TX Power Select		

The RF power output shall be 5 Watt maximum and 1 Watt minimum. The Contractor shall provide, and install in the case of the offices and vehicles, the following number of radios:

- a) 1 x main fixed radio for the main contractor establishment area;
- b) 1 x main fixed radio per each work front office;

PART C3.1 - SPECIFICATION

- c) 50 x mobile radios for vehicles as per 2-way radio specification above; and
- d) 50 x portable hand-held radios as per 2-way radio specification above.

Each portable hand-held radio shall have one charger, one belt clip, one sling and one spare battery (total 2 batteries). The battery life of the radio batteries shall be 1 Amp hour minimum.

At least three channels shall be available for the Engineer's staff exclusive use and one channel for communications between the Engineer's staff and the Contractor's staff. The Contractor shall ensure that all necessary licenses are obtained from the relevant authorities and maintained to operate the system for the duration of the Contract.

The Contractor shall ensure that the radio service for the voice networks and the satellite networks for the data (e-mail, internet service) are the most feasible solutions for the Site.

1.7.13.3 Mobile Satellite Phones

Mobile satellite phones shall be provided by the Contractor for use by senior and/or designated employees from the Contractor, Employer and Engineer at the complete Site for the full construction period up to the issue of the last Taking – Over Certificate.

A fixed satellite base station shall be erected at the Contractor Camp site to enable data communication via email and the internet. A 10 Mps satellite connection should be the minimum for this.

1.7.14 Engineer's Site Equipment

On instruction of the Engineer the Contractor shall supply and service, as may be applicable, survey, photographic, field testing and laboratory equipment for exclusive use by the Engineer. Annexure 1/5 - Engineer's Survey Equipment of this Section is an indicative list of survey equipment that will be required by the Engineer. All such equipment must be approved by the Engineer before it is purchased and the Contractor shall provide the equipment within 21 days after receipt of an order from the Engineer.

The Contractor shall provide and maintain such further equipment, apparatus and facilities as may be ordered by the Engineer. A Provisional Sum is provided in the Bill of Quantities for such equipment.

1.7.15 Factory Acceptance Testing (FAT) and quality monitoring outside the borders of South Africa

The Contractor shall be responsible for all arrangements and all costs for the attendance of the Engineer and the Employer (4 persons in total) of any FAT and any quality control at factories outside the borders of South Africa. The cost shall include all related expenses relating to travelling, which shall include for the following:

- Accommodation;
- All meals;
- All travelling (flights and other transport outside the borders of South Africa); and
- Sundries up to 10% of the total value of Clause 1.7.15.

1.8 FACILITIES PROVIDED BY THE CONTRACTOR FOR THE WORKS

1.8.1 General

The requirements of this Clause shall apply, *mutatis mutandis*, to the facilities to be provided and maintained as detailed in Clauses 1.6 and 1.7.

The Contractor shall provide and maintain the facilities on the Site for the durations required by the Contract.

As far as is practicable such long-term facilities and services as are required in terms of Clauses 1.8.3 and 1.7.3 shall be established as early as possible in order to constitute part of the interim provision where the Contractor is required to provide any interim facilities or services. This is specifically required to minimise the scope of the interim facilities and to facilitate the immediate connection of the long-term facilities.

The Contractor shall keep the working and establishment areas, and in particular the material lay down areas, neat and tidy.

All Subcontractor establishments must be contained within the Contractor's fenced establishment areas. On completion of the Works, Site fencing shall be removed and the Contractor shall reinstate disturbed areas in accordance with Section 47 – Landscaping and Rehabilitation.

If a facility is provided, maintained and/or operated by the Contractor, all of the Contractor's charges for such shall be deemed to be included in the rates and prices in the Bill of Quantities.

1.8.1.1 Records and Handovers

For each designated area of the Site and its surrounds the Contractor shall, together with the Engineer, within 28 days prior to the establishment of any facility or the commencement of any work thereon, make detailed records, including photographs and video records, of the existing state of all areas, structures, dwellings, facilities and other features that will be affected by his activities.

Such records, photographs, video material, drawings or statements as appropriate, shall be dated and two (2) copies of each shall be submitted to the Engineer prior to the establishment of that facility or the commencement of work in that area. The Contractor shall also maintain a duplicate record on Site.

1.8.1.2 Layouts and Details to be Submitted

Within 14 days after the Commencement Date (or earlier as required in terms of the Tendered Contract Programme) the Contractor shall submit a Method Statement together with general drawings, proposals and a programme for the establishment of the facilities provided by the Contractor (in terms of this Clause and Clause 1.7) to the Engineer for approval. Where layouts are shown on the Tender Drawings these are indicative only and may be altered by agreement with the Engineer. The Contractor shall indicate on the programme the dates of submission to the Engineer of the details for each facility (as specified below and in Clause 1.7) and the latest date by which the Engineer's approval is required for that facility, which shall be at least 14 days later than the date of submission to the Engineer.

PART C3.1 - SPECIFICATION

The facilities referred to above shall include, but not be limited to all buildings, offices, lay down yards, vehicle wash areas, fuel storage areas, screening Plant (if applicable), batching areas and any other infrastructure required for the running of the Site.

The Contractor shall keep updated and provide to the Engineer one paper copy and one CD containing CAD and pdf files of all general layout drawings of his establishment facilities and access roads.

1.8.1.3 Clearing, Maintenance and Rehabilitation

After clearing of required areas in accordance with Section 7 – Clearing of Site, the buildings, facilities and equipment provided by the Contractor shall be erected in the positions approved by the Engineer.

The Contractor shall be responsible for keeping all areas of the Site for which he is responsible, including temporary facilities, buildings, services, etc., in a neat, clean, sanitary and orderly condition.

The Contractor shall dismantle and remove from the Site all facilities provided under this Clause and Clause 1.7 which are no longer required, as agreed by the Engineer, and shall rehabilitate all affected areas in accordance with Section 47 - Landscaping and Rehabilitation.

1.8.1.4 Transport of Site Staff and Labour

The Contractor shall be entirely responsible for the provision and maintenance of proper transport facilities for all his Site staff and labour for each working day or shift as the case may be. Such transport and any other transport provided for his employees shall be safe, covered and maintained in satisfactory working condition at all times and shall be in accordance with the approved Health and Safety Plan and as specified in Section 2 – Occupational Health and Safety.

1.8.2 Interim Facilities

1.8.2.1 General Requirements

Until such times as the Contractor has established the various long-term services and/or facilities to the construction establishment areas as specified in Clause 1.8.3, the Contractor shall take such interim measures as are necessary to ensure the early and continued availability of all necessary services or facilities to the Site, including for the Engineer's requirements, such that the Works are in no way adversely affected.

Interim facilities for the Contractor shall be in place at the start of any construction activities on Site and shall be used for a maximum of 56 days from the Commencement Date, by which time the Contractor's long-term facilities shall be in place.

1.8.2.2 Office and other Facilities

The Contractor shall be responsible for providing, maintaining and servicing interim offices and other facilities, including security fencing, until his long-term offices and other facilities have been established.

PART C3.1 - SPECIFICATION

The Contractor shall provide, equip and maintain an interim laboratory of sufficient size and equipped to conduct the testing that may be required until such time that the permanent Site laboratory have been constructed. These laboratories shall be for the joint use of the Engineer and the Contractor under the same provisions as Clause 1.8.3.9.

1.8.2.3 Services

The Contractor shall be responsible for the timeous provision, operation and maintenance of all necessary interim services, such as power supply, roads, water supply, sewerage and sewage treatment, communications, medical, sanitation and cleaning, access control and security, and fire control for the due fulfilment of the Contract, until his long-term supplies to the construction establishment areas have been established.

The standard of the services shall be in accordance with the requirements of Clause 1.8.3 in terms of water quality and sewage treatment quality.

1.8.3 Long-Term Facilities**1.8.3.1 Construction Establishment Fencing**

Each construction establishment area for the Contractor as defined in Clause 1.4.1 b) shall be surrounded by boundary fencing with gates, to be provided, erected and maintained by the Contractor to properly surveyed and cleared lines. Boundary fencing shall be as specified in Section 6 – Fencing and shown on Drawings.

In addition, the Engineer's facilities as stated in Clause 1.7, the Contractor's and Subcontractor's offices, workshops, stores, explosives magazines, fuel depots and other sensitive facilities shall be surrounded by security fencing as specified in Section 6 – Fencing and shown on Drawings. Security fencing shall be erected prior to the installation of any facilities, interim and long-term, inside the fenced area.

When no longer required such security fencing shall be dismantled and removed. In areas where the secure area is adjacent to the boundary of the area as defined in Clause 1.4.1 b), the boundary fence shall be replaced by security fence as specified in this clause.

1.8.3.2 Lighting of Construction Establishment Areas

Flood-lighting of the areas shall be provided to allow safe movement of persons in each area at night. Lighting and floodlighting shall be of the downward facing spill off type.

1.8.3.3 Access and Haul Roads**(a) Construction Establishment Access Roads**

The Contractor shall provide access and feeder roads as well as parking areas within the construction establishment areas. Each building shall be suitably connected to the roads and/or parking areas by way of footpaths 1 m wide. The roads shall be at least 6 m wide and parking areas shall be off-road.

The access and other roads and parking areas around the buildings shall be treated to make them dust free, by using crushed stone, bituminous surfacing, or by other approved means. Spraying

with water shall not be used. Footpaths shall be similarly treated to provide convenient access to all buildings. Sufficient storm water drainage shall be provided to minimise the formation of puddles, ponds and the like, and shall include the measures specified in Section 27 – Drainage and Erosion Protection.

(b) Access / Haul Roads

Except for construction roads in the pipeline servitude, the Contractor shall not construct any new roads outside the pipeline servitude other than those shown on the Drawings.

The Contractor shall upgrade, construct or extend and maintain as necessary, temporary access, haulage or construction roads required for all weather usage, including the provision of road furniture, storm water drains and culverts, for the due fulfilment of the Contract. Where such roads require the approval of Provincial or Local Authorities, the Contractor shall be responsible for timely arrangements, and liaison with the relevant Authorities through the Employer as well as for any levies, costs, charges and compensations that may be required. The Contractor shall provide the Engineer with copies of all correspondence in this regard.

The Contractor will be required to undertake periodic maintenance of existing public roads that are being trafficked by construction vehicles, such as watering, grading and re-gravelling. The Engineer retain the right to instruct the Contractor to do additional maintenance on an ad hoc basis. Maintenance standards shall be as specified in Section 26 – Road Maintenance.

Protection against shoulder damage will be required where gravel haul roads join surfaced roads as specified in Section 26 – Road Maintenance and as shown on the Drawings.

Where access roads are to be fenced and gated such as on non-public roads, the Contractor shall be responsible for the fencing (which shall be boundary fencing as specified in Clause 1.8.3.14), gates and appropriate signs, in advance of using these access roads.

The Contractor's employees may not enter at any time any private properties along the pipeline route without the written permission and the co-ordination of the landowner and Engineer.

All access roads constructed by the Contractor in terms of this Clause shall be rehabilitated in accordance with Section 47 - Landscaping and Rehabilitation unless otherwise instructed by the Engineer.

(c) Access of Landowners along Pipeline Servitude

In certain areas the pipeline servitude may intersect the only means of access to and from parts of the properties of certain landowners. In such areas the Contractor shall ensure continuous and safe vehicular access to these landowners by either constructing bypass roads and/or providing the owners of these vehicles with any necessary Health and Safety training and equipment for their vehicles to be able to safely use the temporary access roads via the construction areas. The Contractor shall provide induction training to these landowners.

1.8.3.4 Electrical Power and Distribution

The Contractor shall provide his own electrical power for the Works as per Clause 1.7.9. Where there is no power connection point, the Contractor shall provide, operate and maintain power supply generators and the like as required for the construction of the Works. All installations shall comply

with the Eskom or relevant Local Authority regulations and be carried out by suitably qualified electricians.

Whenever the Contractor is engaged in night work he shall provide and maintain in good condition, adequate high powered flood lighting for all parts of the Works on which he is occupied. Lighting of work areas and access thereto shall be in accordance with Section 2 – Occupational Health and Safety.

The Contractor shall provide at the establishment areas suitable standby generating capacity, which shall be continuously available for immediate and automatic connection and supply in case of breakdown of the normal supply.

1.8.3.5 Water supply

Refer to Clause 1.7.10. The Contractor shall make all arrangements necessary for the provision, storage, purification and distribution of water for the due fulfilment of the Contract including to the various offices, buildings, other Site facilities and work fronts.

Potable water shall comply with the requirements of SANS 241 - Drinking Water standards.

1.8.3.6 Sewerage, Sewage Treatment and Disposal

Refer to Clause 1.7.11. The Contractor shall provide for the reticulation, collection and treatment of all sewage on the Site.

The treatment facilities, at the Construction establishment areas, shall be either conservancy tanks or package plants. Other facilities such as pit latrines, septic tanks, french drain systems or soak away systems will not be permitted. Facilities shall be subject to approval by the Engineer and shall conform to the by-laws of the relevant Local Authority and the National Environmental Management: Waste Act (Act 59 of 2008) and the Water Act (Act 36 of 1998).

Where the Contractor provides and uses conservancy tanks each tank shall be appropriately designed with adequate capacity but not less than 5 000 litres.

Adequate numbers of toilets for both genders and commensurate with the workforce and the requirements of Section 2 – Occupational Health and Safety shall be provided.

Mobile chemical toilet facilities shall be allowed along the pipeline routes.

All ablution facilities, close to the Site boundaries or within sight of residential areas shall be hidden behind walls, screens or other cover as approved by the Engineer.

The Contractor shall ensure that toilets are always kept in a hygienic and disinfected condition by regular attendance and supplied with toilet paper, water, soap, sanitizer and towels.

All sewage screenings and sludge shall be removed regularly as needed and disposed of at an approved wastewater treatment facility by a licensed service provider. If conservancy tanks are provided the Contractor shall arrange for the removal and disposal of the sewage at such regular intervals as to avoid surcharging of the tanks, but at least once per week.

1.8.3.7 Communications

Refer to Clause 1.7.13. The Contractor shall provide all communication facilities to and within the Site for the due fulfilment of the Contract.

The Contractor shall be responsible for all arrangements necessary with the designated ISP (Internet Service Provider), other authorities and service providers. The Contractor shall also be responsible for all levies, charges, etc. in this regard.

The Contractor shall be responsible for connecting his local telecommunications network and systems into the ISP point of supply. Such communications shall be connected or provided such that effective and efficient communication within the Site and externally is maintained at all times during the Contract, especially under emergency circumstances.

The Contractor shall be responsible for the operation and maintenance of all communications systems including the radio equipment.

1.8.3.8 Office, Accommodation and Other Site facilities**(a) General**

Except as otherwise specified, the Contractor shall be entirely responsible for the design, provision, construction and maintenance of all the offices and other facilities which may be required by the Contractor for the due fulfilment of the Contract.

(b) Residential Accommodation

The Contractor shall not be permitted to construct residential accommodation at any of his construction establishment areas or anywhere on Site. Areas for residential accommodation shall only be established within existing developed areas zoned for residential housing, to the standards and approval of the relevant Local Authority and that of Section 2 – Occupational Health and Safety.

The Contractor shall provide and maintain all housing and all necessary services for his Site staff.

(c) Office Accommodation

The Contractor shall supply sufficient office accommodation for his [and his Subcontractors] needs in the construction establishment areas.

(d) Other Construction Establishment Facilities

The Contractor shall provide for his own canteens, workshops, storage sheds, yards, explosives magazines, fuel depots, tanks, loading platforms, weighbridges, laboratories, housing, water treatment facilities, etc.

The Contractor shall arrange with the relevant Local Authority for secure and unobtrusive overnight parking of his transport / haulage fleet as may be appropriate.

(e) Storage

Storage accommodation for equipment, Plant and materials shall be well ventilated, weather and damp proof, with floors raised 225 mm above natural ground level.

The facilities shall be subject to the approval of the Engineer, who shall have full access to them at all reasonable times. Site storage buildings shall be maintained in good condition and appearance. Fuel shall be stored in properly constructed storage tanks and bunded as specified in Section 4 – Environmental Management. Fuel installations shall be secure against access by unauthorized persons.

1.8.3.9 Laboratory

The Contractor shall construct, furnish, equip (including heating / air conditioners) and maintain for the duration of the Contract a fully equipped Site laboratory in the vicinity of the Engineer's Site office.

The laboratory shall be managed, staffed and operated by the Contractor, but shall be available for use by the Engineer on a shared basis.

The laboratory facilities provided shall be constructed, furnished and managed in such a manner as to allow smooth performance of the tests to be carried out within the framework of the Contractor's Quality Management system. This includes the trial, acceptance and routine tests by the Contractor and tests by the Engineer within the framework of the complementary investigations and from time to time during the course of the Works.

The Contractor shall undertake all necessary testing in the Site laboratory and, if appropriate, in an approved commercial facility off Site. Only laboratories that are accredited by SANAS as being ISO 17025 compliant will be approved. The Site laboratory shall be inspected and audited at 6 monthly intervals by an independent SANAS accredited laboratory and the Contractor shall allow for this in his rates.

The Contractor shall:

- a) Construct the laboratory of sufficient size and floor plan to accommodate all of his own needs, as well as those of the Engineer as stated in Annexure 1/2 of this Section 1;
- b) Fully service and maintain the laboratories to the same standards as for the Engineer's Office with electricity, Site access roads, raw and potable water, heating, sewerage and voice communication, email facilities and the like;
- c) Provide, service and maintain any auxiliary testing facilities wherever required by the Contract on the Site as agreed with the Engineer;
- d) Provide and maintain equipment and apparatus of the respective types and extent necessary to enable all testing to be properly and efficiently undertaken. The equipment and apparatus shall all be new and shall comprise at least those items specified in the list of laboratory equipment as stated in Annexure 1/3 of this Section 1 and capable of serving all throughputs arising from both the Contractor's testing requirements and those of the Engineer. Such equipment and apparatus shall be subject to prior agreement with the Engineer before ordering and shall remain the property of the Contractor on completion of the Contract;
- e) Provide and maintain such further equipment, apparatus and facilities as may be ordered by the Engineer. A Provisional Sum is provided in the Bill of Quantities for such equipment;
- f) Provide all consumables required for the day to day running of the laboratory and auxiliary facilities;

PART C3.1 - SPECIFICATION

- g) Have undertaken by independent, recognised standards laboratories, initial and regular calibrations of all equipment and apparatus to a programme as agreed with the Engineer;
- h) Provide and maintain equipment, apparatus and facilities necessary to enable all testing to be properly and efficiently undertaken at each work front;
- i) Be responsible for the planning and programming of all testing work to be undertaken by the Contractor together with the Engineer's own acceptance testing and quality monitoring requirements;
- j) Provide all labour, assistance and qualified testing staff as required;
- k) Provide laboratory assistants and the labour required by the Engineer for his testing, which personnel shall fall under the control and direction of the Engineer and shall comprise those listed in Clause 1.7.4 as applicable;
- l) Arrange for such tests not provided for in the Specification to be undertaken on instruction of the Engineer. Payment for this testing will be made under a Provisional Sum;
- m) Arrange for independent duplicate testing to be undertaken by a recognised commercial laboratory (SANAS accredited as being ISO 17025 compliant or similar) at a frequency as required by the Engineer. Payment for this testing will be made under a Provisional Sum;
- n) Insure the equipment; and
- o) Dispose of waste generated by the laboratory in accordance with relevant Environmental regulations.

Notwithstanding any testing carried out by the Engineer, the Contractor shall remain responsible for ensuring that the Works are constructed in conformity with the Contract. He shall therefore undertake the proper testing, monitoring, quality control and reporting of test results, etc. within the framework of the Contractor's Quality Management System as specified in Clause 1.10.2.2.

The Site laboratory shall be established within 56 days of the Commencement Date. Work on the Permanent Works will not be allowed to continue until such long-term laboratory has been established.

1.8.3.10 Name Boards and Signs

The Contractor shall, within 28 days after the Commencement Date provide, erect and maintain six (6) project name boards. The general arrangement of the boards is shown on the Drawings and they shall be erected at a height of at least 2 m above ground level at locations agreed with the Engineer.

The Contractor and Subcontractors shall each be restricted to two company name boards within the Site boundaries of each of the construction establishment areas.

Name boards and signs shall be fabricated from durable materials such as Chromadex G275 galvanised steel plate (or equivalent) that will not distort due to weather conditions and shall be mounted on poles adequately braced to prevent wind damage. The Contractor shall keep all name boards and signs in good repair, order and legibility.

The Engineer will instruct the removal and replacement of any name board or sign which falls into disrepair or becomes illegible. All costs so incurred shall be allowed for in the Contractor's rates.

The Contractor shall be responsible for obtaining any approvals needed for the installation of name and signs boards in any specific locations, and ensure that he fully complies with the requirements of the Advertising on Roads and Ribbon Development Act 21 of 1940.

The Contractor shall remove all name boards, signs, supports and foundations at the issue of the last Taking-Over Certificate and rehabilitate the areas in accordance with Section 47 – Landscaping and Rehabilitation.

1.8.3.11 Weather Measurements

The Contractor shall establish a primary weather station at the Highlift Pumping Station or as agreed by the Engineer.

The Contractor shall continually record the following at the primary weather station and submit the records weekly to the Engineer:

- a) Continuous temperature readings;
- b) Maximum and minimum daily temperatures;
- c) Precipitation including hail;
- d) Relative humidity;
- e) Average hourly wind speed and direction; and
- f) Barometric pressure.

The Contractor shall also establish three additional secondary weather stations along the pipeline routes at positions agreed with the Engineer and submit weekly records of the following to the Engineer:

- a) Daily maximum and minimum temperatures;
- b) Daily precipitation including hail; and
- c) Average hourly wind speed and direction.

The Contractor shall also establish six additional tertiary weather stations along the pipeline routes at positions agreed with the Engineer and submit weekly records of the daily precipitation including hail to the Engineer.

For this purpose, the Contractor shall provide and maintain (including initial and subsequent calibration at least once every six months) standard weather recording instruments as approved by the Engineer and house them in accordance with the manufacturer's instructions.

1.8.3.12 Medical

First aid stations shall be provided at prominently marked locations and within 100 m at each area where a construction team is working on the Site. The first aid boxes shall be in easily accessible positions. If a box is kept locked, a person holding the key shall be present and within hailing distance of the box at all times that work is in progress in the area which the box is intended to serve. First aid boxes shall comply with the requirements of Section 2 – Occupational Health and Safety.

The Contractor shall make all arrangements necessary for emergency services to transfer / evacuate serious cases to suitable local medical facilities e.g. hospitals or clinics including if necessary access to evacuation by air. For this purpose he shall enter into an agreement with a recognised service provider for evacuation by road and/or air.

PART C3.1 - SPECIFICATION

The Contractor shall familiarise himself with the location, operational hours, capacity and range of facilities and equipment available at proximate medical facilities.

The Contractor shall provide a helipad and associated requirements (e.g. a windsock) to the Civil Aviation Authority standards for the area at the main establishment area or at an alternative location which shall be agreed with the Engineer.

1.8.3.13 Sanitation and Cleaning**(a) General**

The Contractor shall maintain the Site and all facilities for which he is responsible under the Contract to ensure that they are in a clean, neat and sanitary condition at all times and shall comply with the Health and Safety Plan.

(b) Refuse Collection and Disposal

The Contractor shall be responsible for all collection, removal and safe disposal of Site refuse.

Metal refuse bins to BS 792 or equivalent plastic refuse bins, all with lids, shall be provided by the Contractor for all buildings and refuse shall be collected and removed from all facilities on the Site at least twice per week. Refuse from food preparation and eating areas shall be collected and removed daily. Refuse shall be transported to an approved refuse disposal site in covered containers or covered trucks.

Refuse disposal shall further be in accordance with Section 4 – Integrated Environmental Management.

(c) Pest and Vermin Control

The Contractor shall propose and execute a programme agreed with the Engineer to control noxious pests and vermin on the Site. Use of residual pesticides will not be permitted.

1.8.3.14 Access Control and Security**(a) Access Control**

The Contractor shall control access to the Site. At all access points to the servitude the Contractor shall provide access control by means of a security guard and lockable gates as per Section 6 – Fencing to prevent unauthorized persons from entering the pipeline servitude at all times.

(b) Security

Within 28 days of the Commencement Date, the Contractor shall institute a security system to cover all areas of the Works as approved by the Engineer.

The Contractor shall be responsible for providing, operating and maintaining the security system including personnel, vehicles, equipment, access control buildings, guard shelters, barriers / booms, identification systems, administration, management and the like.

PART C3.1 - SPECIFICATION

Within 7 days of the Commencement Date, the Contractor shall submit to the Engineer for approval a Method Statement containing a full description of the security policies and systems he proposes to adopt on the Site. The system shall operate on a continuous 24 hour per day 7 days per week basis for the duration of the Contract. The system shall include full and effective security control of all accesses to each work front including appropriate identification procedures for all persons and vehicles entering and leaving the Site.

The Contractor shall co-operate with the South African Police Services (SAPS) and comply with the Engineer's requirements on all matters relating to security of the Works and persons entering the Site.

The Contractor shall prevent firearms from being brought on to the Site. He shall include, in all employees' contracts, the right to search employees for firearms or other weapons as well as the right to remove the firearm or weapon and store it in a place of safety, until it can be handed back to the employee. The Contractor shall make the right to search vehicles and visitors for firearms upon entry to the Site, a condition for entry. Applicable signs shall be erected at the entrances to the Site.

The Contractor may employ a security firm approved by the Engineer. Notwithstanding the Engineer's approval, compliance with the requirements of the Specification shall remain the responsibility of the Contractor. Such a security firm shall be supplied with radio communication equipment to enable reliable communication between themselves and the Contractor, Engineer and landowners along the pipeline route.

This section shall be read in conjunction with the requirements specified in the Project Environmental Authorisation (Reference Number: 14/12/16/3/3/2/1100), specifically Condition 54, and Section 3: Social Management and Socio-Economic Development Requirements, Clause 3.4.4.4, Managing Security Concerns.

1.8.3.15 Fire Control

The Contractor shall take all reasonable precautions against the outbreak of fire. Smoking may only be permitted in designated areas. All other areas of the Site shall be smoke free zones.

No open fires will be permitted in any area under the control of the Contractor. Grass and other vegetation in the vicinity of all buildings shall be cut at regular intervals to reduce fire hazards. Adequate fire breaks shall be cut and maintained in all areas within the control of the Contractor, all to the satisfaction of the Engineer.

The Contractor shall provide adequate:

- a) Fire detectors, fire alarms, fire extinguishing and firefighting equipment appropriate to the location and type of fire envisaged. These items shall be regularly maintained and inspected. Each item shall have an up-to-date test certificate. The numbers of these items at each location of the work shall be as consented to by the Engineer.
- b) A nucleus of personnel trained in firefighting, and in the use of firefighting equipment, such as respirators. These personnel shall be under the supervision of a person experienced in firefighting on construction sites. The nucleus of trained fire fighters and supervisors shall be effective within 28 days after the Commencement Date.

The Contractor shall provide and maintain at each of the work fronts a firefighting service, including at each of these areas a diesel powered vehicle equipped with a water tank of minimum 10 000 litre capacity, portable pumps, suction and 100 metres of delivery hose with suitable couplings, dry powder fire extinguishers, breathing apparatus and other necessary equipment, tools, suitable

PART C3.1 - SPECIFICATION

protective clothing, etc. The Contractor shall staff and administer this service to the satisfaction of the Engineer. The firefighting services shall be maintained in a good and ready state and shall be available on a continuous basis for each front, together with a water filling point for the tanker. The Contractor shall institute a warning and call out system to ensure that the firefighting teams and equipment can concentrate on any fire effectively, and in the appropriate manner, in the shortest possible time.

The Contractor shall, in consultation with the Safety Committee and the Engineer, publish operating requirements governing the call out and use of the service. Notices in English and in any other languages as may be relevant to the workforce shall be prominently displayed giving instructions as to how the service can be summoned. The warning and call-out system shall be incorporated in the Contractor's emergency evacuation procedures required in the Health and Safety Specification.

The effectiveness of the service shall be tested at least 3 times each year under the inspection of the Engineer.

In the event of a fire, the Contractor shall mobilise his firefighting team in accordance with the procedures of the local fire management organisation in the area.

1.9 PROGRAMMING REQUIREMENTS

1.9.1 General

The preparation of up-to-date programmes, at intervals as required is an essential requirement for the proper planning and management of the Contract. Updated programmes shall include supporting reports, resource levels (supervision, labour and Contractor's Equipment) and Method Statements all in accordance with the Contract, and shall reflect, correctly and in the required detail, the progression of the Contract.

Such programmes, supporting reports and Method Statements shall be used by the Contractor to plan, execute and control the Works, inter-alia:

- a) To monitor and record progress relative to completion requirements and significant dates and for the preparation of schedules and graphs for progress meetings and reports (Clause 1.9.6);
- b) As the basis for scheduling the issue by the Engineer of construction Drawings;
- c) As the basis for scheduling submissions by the Contractor to the Engineer of his various Plans, Method Statements, Designs, Drawings and other Contractor's Documents;
- d) As the basis for scheduling quality inspections, monitoring at hold points and tests by the Engineer and/or the AIA as covered in more detail in the Specification;
- e) As a basis for planning and monitoring resource allocations;
- f) To assess interaction and co-ordination with Subcontractors from various disciplines;
- g) As the basis for planning, scheduling and coordinating dry season construction activities;
- h) As the basis for planning and scheduling hydrostatic testing on the pipelines. (Note: Test sections may be different to the work fronts);
- i) As the basis for scheduling Tests on Completion;
- j) To assess the need for formal revision of the Contract Programme as described in Conditions of Contract Sub-Clause 8.3 and Clause 1.9.5;
- k) To generate input to cost flow and cash flow forecasts / actuals; and
- l) As an indication of the timing of key events such as resources mobilisation and delivery to Site of Plant and materials.

PART C3.1 - SPECIFICATION

These documents shall also be used:

- a) As essential input to payment procedures in accordance with Clause 14 of the Conditions of Contract and Clause 1.15 of this Section; and
- b) As essential documentation in the assessment of time extensions and delay effects in accordance with Clause 8 of the Conditions of Contract and Clause 1.15.8.1 of this Section.

In order to achieve the above objectives, it is important that the respective programmes be developed as realistic, correct and adequate for use as described above by the Contractor and the Employer / Engineer. With this in mind and to facilitate mutual understanding of the programming and interfaces, impact of delay, variation and disruption events, each programme shall clearly follow the detail required by this Clause 1.9, including the demonstration of free and total float in each part, Part or Section of the Works and for the whole of the Works. Such floats shall be available for the benefit of the project and not for the exclusive benefit of one or the other of the Parties of the Works.

Where remaining float exists in the programme at the time of an event for which the Employer is responsible under the Contract for an extension of the Time for Completion in accordance with Sub-Clause 8.4 of the Conditions of Contract, such extension will only be granted to the extent that the event will reduce to below zero the total float on the activity paths, i.e., when those activity paths become critical as a result of the event, and compensation made accordingly.

The Contractor shall supply to the Engineer two original versions of the Planning Software, each licensed for network use by 3 persons. The provision of this software shall include for upgrades for each license whenever these are issued by the supplier. Whenever the Contractor submits a programme to the Engineer he shall supply the Engineer with an electronic copy of each programme, together with a hard-copy print out of the bar chart or tabular report in a format agreed to by the Engineer. All programmes shall be prepared and submitted using this Planning Software. The Contractor shall employ a planner who shall be skilled in the logistics and planning and control of construction projects, with proper support staff and systems. The planner shall be experienced in the application of the necessary range of computer software, including the Planning Software to handle all aspects of the engineering, financial and construction processes. The planner shall be responsible for the whole process including monthly progress reporting and the regular and frequent submission of documentation and programmes necessary to fulfil the requirements of the Contract. Maximum advantage must be gained for the project from the effective and skilful use of the programmes. To facilitate this and create mutual understanding of these sophisticated tools, it is required that the planner adopts a team approach with the Engineer's designated programming assistant, especially regarding weekly and monthly reporting as well as for programme updates. The establishment and maintenance of such a team approach will be a condition precedent to the Engineer certifying relevant charges under the Bill of Quantities.

Notwithstanding the above requirements, the Contractor shall remain fully and solely responsible for the timeous and proper execution of the Works in accordance with the Conditions of Contract, inter-alia with Clause 4 and Sub-Clause 8.2 thereof.

1.9.2 Programme Considerations

The Works and Parts thereof shall be completed within the respective periods for completion given in the Appendix to Tender. The Contractor shall enter the overall times for completion for each Part of the Works. Such overall times shall be inclusive of float and discontinuities in the Contractor's Programme.

The Contractor shall plan and programme all activities required to achieve the various specified Times for Completion taking due account of all requirements of the Contract. The Contractor shall also co-ordinate the programming of these Works with the Engineer and end users.

1.9.2.1 Tests on Completion

Commissioning procedures and requirements are stated in Section 48 – Tests on Completion, for the following stages:

- a) Ready for Pre-commissioning (RFPC);
- b) Ready for Commissioning (RFC);
- c) Ready for Trial Operation (RFTO); and
- d) Ready for Operation (RFO).

In respect of Tests on Completion, the Contractor shall take also the following into consideration in his planning and programming:

- a) Tests (e.g. factory tests) associated with manufacturing of Plant, including pumps, motors, switchgear, pipes, valves, pipe specials and fittings;
- b) Installation of any necessary Temporary Works;
- c) Hydrostatic testing of the pipelines;
- d) Restrictions associated with operation requirements of the end users and coordination with the users through the Engineer; and
- e) Testing of the installed Plant.

1.9.3 Tendered Contract Programme

The Contractor shall have submitted a programme with his Tender to define the duration of the construction activities in connection with the various Parts of the Works. Such programme shall have been designated the “Tendered Contract Programme”, and shall form the basis of the Initial and Contract programmes pursuant to the Conditions of Contract, Sub-Clause 8.3.

1.9.4 Initial Programme

The Initial Programme shall show the first six months’ work in the same level of detail as is required for the Contract Programme set out in Clause 1.9.5 below, but only insofar as it applies to the first six months of the Contract period after the Commencement Date.

The Initial Programme shall be presented electronically as required by Clause 1.9.1 above, and also as a programme in bar chart form showing the detailed activities in the period covered by the precedence network diagram, together with the major activities and milestones in the remainder of the period of the Contract. The Initial Programme shall be accompanied by the schedules referred to in Clause 1.9.5 below as advised by the Engineer by the Commencement Date. The Initial Contract Programme shall be maintained and managed as stated in Clause 1.9.6 below.

1.9.5 Contract Programme

The detailed time programme to be submitted in terms of Sub-Clause 8.3 of the Conditions of Contract as the Contract Programme shall be an update and expansion of the Tendered Contract

PART C3.1 - SPECIFICATION

Programme and the Initial Programme. Any revisions and alterations to the Contract Programme shall be in accordance with Conditions of Contract Sub-Clause 8.3 and with this Clause 1.9.5.

Requirements of and supporting data / information required with the Contract Programme and any updates thereto include the following:

- a) The Contract Programme shall be fully integrated, i.e. the programme, billed quantities and amounts and resources integrated;
- b) The Contract Programme shall include information on shutdown periods, vacation days and other non-working time periods. Allowance shall also be made for climatic conditions (including wet seasons) and any conditions arising from climatic conditions, which allowances shall include for all effects not provided for in Sub-Clauses 8.4 (c) and 19.1 (v) of the Conditions of Contract accumulated over the whole Time for Completion;
- c) The Contract Programme shall clearly show the interrelationship of all activities in the programme and shall include logic-linked annotated bar charts (Gantt charts). In particular, the linkages and constraints between activities / rational stages and resources deployment shall be clearly identified by way of a precedence network diagram, and shall show as far as reasonably practicable:
 - i) Commencement Date of the Works;
 - ii) The activities in all work packages including those by the principal Subcontractors and suppliers, statutory undertakers, those contractors and suppliers directly employed by the Employer and others. Where complete work packages are undertaken by Subcontractors, these shall be identified separately as such and programmed with their own chain of activities, critical path and completion dates within the Contract Programme and shall reflect all the requirements;
 - iii) The earliest and latest start and finish dates for every activity in each work package. Activities shall include all scope activities and any activities or time durations expected in addition to scope activities;
 - iv) Access dates for each Section or Part of the Works;
 - v) Completion dates for each phase, Section and Part of the Works;
 - vi) The earliest and latest start and finish dates for each phase, Section and Part, including dates when the Contractor plans to complete work to allow the Employer and others to undertake their work;
 - vii) Milestone and Key Dates;
 - viii) Non-working days / periods;
 - ix) Pay weekends;
 - x) Allowance to be made for anticipated rainy days;
 - xi) Dates by which Contractor's Documents and/or samples (or those of Subcontractors or suppliers) will be submitted to the Engineer and dates by which responses to such documents or samples will be required by the Contractor, allowing time for submittals, re-submittals and reviews;
 - xii) Procurement, fabrication, delivery, construction, installation, testing and Tests on Completion of Plant, including pumps, motors, switchgear, controls and instrumentation, pipelines and valves included in the Permanent Works;
 - xiii) Dates by which work will be ready for testing by the Engineer, the AIA or the Employer;
 - xiv) Details and dates by when any access permissions and/or information will be required from the Employer;

PART C3.1 - SPECIFICATION

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- xv) The work contained in defined Provisional Sums;
 - xvi) Activities representing the likely work content of undefined Provisional Sums, complete with logic links but with durations set to zero (unless specified otherwise);
 - xvii) Dates for landscaping, rehabilitation and establishment of vegetation;
 - xviii) Commissioning processes, including factory testing periods for Plant where applicable;
 - xix) Provisions for float, time risk allowances, quality control procedures, health and safety, environmental and social requirements (and any other requirements that may be set out in the Contract);
 - xx) Allowance for the items in Clause 1.9.2 above;
 - xxi) Scheduled servicing and/or maintenance inspections and works during the Defects Notification Period; and
 - xxii) Completion of the Works showing Ready for Beneficial Operation (RFBO) (if applicable), Ready for Commissioning (RFC), Ready for Trial Operation (RFTO) and Ready for Operation (RFO).
- d) In relation to each activity, the following minimum information shall also be able to be presented:
- i) Unique identification number (ID);
 - ii) Description;
 - iii) Duration in working days;
 - iv) Key quantities from the Bill of Quantities and related overall production rates (i.e. the quantity and production required to accord with the duration of the activity);
 - v) Resources allocations / loading (including Contractor's equipment, Temporary Works, supervision and labour) for the execution of the activity within its programmed duration;
 - vi) Calendar ID / designation;
 - vii) Early start date, early finish date and duration;
 - viii) Total and free float;
 - ix) Highlighting of the critical path through the programme, being that path (or chain of activities) that must be completed on time for the Works, Sections of the Works or Parts of the Works to be completed within the Time for Completion; and
 - x) Any periods of inactivity.

Activities with durations longer than 30 days and less than 7 days should be kept to a minimum to avoid the Contract Programme being inappropriately simplified or becoming too cumbersome with an overload of short-duration activities.

- e) In support of the Contract Programme, and any revision required thereto in terms of the Conditions of Contract Sub-Clause 8.3, the following shall be submitted or revised, as the case may be:
- i) Equipment and manpower resource schedules, and the spread and allocations of resources, including details of the Contractor's resource requirements in terms of manpower, gang sizes, tradesmen, work production rates, items of Plant or equipment and materials and quantities of work allowed for in sufficient detail to explain the Contractor's durations for each group of activities / work package consistent with the similar information linked with each activity;
 - ii) Activities or groups of activities / work packages that may be expedited by use of overtime, additional shifts or any other means shall be identified and explained;

PART C3.1 - SPECIFICATION

- iii) Computer printout presenting calendar information, including identifying the days of working per week, hours and shifts per working day, non-working periods and holidays;
 - iv) Schedule indicating which Bill of Quantities item(s) correspond with which activity. Each relevant activity shall have Bill of Quantity item(s) assigned to it in the schedule and in the electronic version of the programme;
 - v) Each referenced activity shall be clearly linked to the Method Statements submitted in compliance with Clause 1.10;
 - vi) A schedule of all submittals and material procurement activities, including time for submittals, re-submittals and reviews and time for fabrication and delivery of manufactured products. The interdependence of procurement and construction activities shall be included in the schedule;
 - vii) For all activities with float, a schedule of latest start and finish dates for the Engineer's reviews / responses where applicable to Contractor's Documents and/or samples; and
 - viii) A schedule stating the monetary value of each activity for cash flow purposes. The sum of the monetary values shall total the Contract amount. The schedule shall also state the payment items applicable to the activity monetary values.
- f) The format of all outputs and reports from the Contract Programme shall be as agreed by the Engineer.

1.9.6 Contract Programme Maintenance and Progress Monitoring

During the execution of the Contract the Contractor shall comply with the following minimum requirements for Contract Programme maintenance and progress monitoring as a dynamic working tool in managing the Contract:

- a) The Contract Programme shall be maintained using the latest version of the Planning Software, unless otherwise approved by the Engineer;
- b) Five working days before each monthly progress meeting (refer Clause 1.9.7) the Contractor shall submit to the Engineer a programme update that reflects the actual progress against current programmes and the effect on future activities. The programme update shall be scheduled using the first day of the succeeding progress month as the "data date";
- c) The Contractor shall also submit a narrative report with each monthly update including a description of current and anticipated programme-related problem areas, current and anticipated delaying factors and their impact, and an explanation of corrective actions taken or proposed. The report shall also include a schedule showing design information required from the Engineer on a 9 month moving window;
- d) All variances from the Contract Programme shall be promptly reported to the Engineer and the future impact of such variations shall be determined and analysed by the Contractor using network logic and necessary corrective measures established and submitted to the Engineer in both electronic and hard-copy formats for review and response as to compliance with the Contract or otherwise;
- e) The Contractor shall submit to the Engineer a time impact analysis inter alia when, after due and prompt consultation with the Engineer:
 - i) If so required by the Engineer for purposes of evaluating the effect on the Contract Programme of a proposed variation;
 - ii) A current or anticipated delay significantly affects, or would affect, key dates or the sequence of activities;

PART C3.1 - SPECIFICATION

- iii) A significant change in measured quantities is anticipated that is likely to negatively affect the Time for Completion and/or adjustments under Conditions of Contract Sub-Clause 12.3;
- iv) An acceleration in accordance with Conditions of Contract Sub-Clause 8.13 or other time reduction that affects, or would affect, key dates or the sequence of activities;
- v) The Contractor proposes to change any sequence of activities affecting the critical path for the Works, Sections or Parts thereof;
- vi) The Contractor proposes to significantly change, in the opinion of the Engineer, the Contract Programmes;
- vii) The Contractor proposes to significantly change, in the opinion of the Engineer, work methods, Method Statements, equipment, materials or manpower; and
- viii) The Contractor submits a claim for any extension of time in terms of Sub-Clause 8.4 of the Conditions of Contract.

The time impact analysis shall, inter alia, demonstrate as appropriate:

- a) How the Contractor proposes to incorporate the change, delay, variation, requested extension of time, acceleration or other time reduction into the programme;
- b) The impact of each change, delay or time reduction on achieving key dates;
- c) The impact of each variation or requested extension of the Time for Completion on achieving key dates;
- d) The impact of each acceleration or other time reductions on the Contract and Programme; and
- e) The identification of any other mitigation measures to minimise overall the impacts and any costs associated therewith.

When both the Contractor and the Engineer agree on the impact on the Contract Programme, of the change, delay or acceleration or other time reductions, the Contractor shall incorporate the appropriate logic revisions into a revised Contract Programme. Each revision shall be uniquely identified by sequential numbering. When the Contractor and Engineer cannot agree on the impact of the change, delay, extension, acceleration or other time reductions before the next monthly programme update, the Contractor shall incorporate logic revisions that will have the least negative impact on the Time for Completion. The Contractor shall maintain a record of any disagreements with the Engineer and the programme implications thereof.

Once this revised Contract Programme has been submitted to the Engineer and the procedures of the Conditions of Contract, Sub-Clause 8.3 have run, all work shall be executed and monitored against the revised Contract Programme as may have been modified during such procedures.

1.9.7 Progress Meetings

The Contractor will be required to attend regular site meetings with the Engineer in accordance with Clause 1.10.4 where the progress of construction will be reviewed. Such meetings will normally be held monthly and may be attended by representatives of the Employer and other contractors.

The Contractor shall also attend weekly meetings with the Engineer and provide, prior to each meeting as required by the Engineer, two weekly planning schedules showing separately the various activities of the Contractor anticipated over the forthcoming two week period as well as the estimated progress on agreed key items achieved over the preceding week relative to the

programme applicable to that period. One of the weekly meetings of each month will also address the agreement of the formal updating of the Contract Programme as per Clause 1.9.6 b).

1.10 CONSTRUCTION MATTERS AND RECORDS

1.10.1 General Responsibilities

1.10.1.1 Contractor's Methods and Materials

Acceptance of the Tender will not signify acceptance of the Contractor's Equipment, proposed methods of construction, Tendered Contract Programme, Temporary Works or materials, nor will it in any way relieve the Contractor of any of his responsibilities under the Contract. Further it will not be accepted as a basis for claiming additional compensation where the proposed methods of construction or the proposed materials do not comply with the Contract, regardless of whether accepted by the Engineer or not.

Unless stated otherwise, the Contractor shall submit to the Engineer for approval full details of the key construction and key management processes to be applied in the implementation of the Works defined under this Contract. The process detail shall include, but not necessarily be limited to, the methods, equipment, materials and controls proposed for each aspect of the work or installation. These shall be referred to as Method Statements. These Method Statements define how the relevant work processes are to be executed by the Contractor to meet the requirements of the Contract.

The Method Statements integrate all aspects of the work and as such shall detail at least the following in a format and structure to be agreed with the Engineer:

- a) Scope;
- b) Relevant Sections of the Specification;
- c) Management and supervision;
- d) Resources, including involvement of Subcontractors;
- e) Technical execution;
- f) Discipline integration;
- g) Materials;
- h) Occupational health and safety;
- i) Environment;
- j) Social;
- k) Socio-Economic Development;
- l) Quality management, control and assurance;
- m) Communications; and
- n) The like.

The preliminary statements submitted with the tender shall be supplemented and elaborated to fully detailed Method Statements. An indicative list of Method Statements is included in Annexure 1/1 of this Section.

PART C3.1 - SPECIFICATION

Unless stated otherwise, the Contractor shall develop the Method Statements and submit them to the Engineer for approval in order of priority. In order to avoid an overload in the approval process, the Contractor shall allocate a priority to each of his Method Statements submitted in accordance with the following allocations:

- a) Priority 1 - most urgent, for work planned to commence between 28 and 56 days after submission;
- b) Priority 2 - for work to be commenced between 56 and 84 days after submission; and
- c) Priority 3 - least urgent, for work planned to be commenced after 84 days after submission.

The Contractor shall plan the submission of his Method Statements in accordance with the following 28-day programme:

- a) First submission – as soon as possible, but no later than 28 days before the programmed commencement of the work forming the subject of the Method Statement; Where the lead time to implement a Method Statement requires early approval by the Engineer, the Contractor shall make his first submission accordingly early;
- b) Comment by the Engineer (in the event the first submission is not approved) – will be given within 14 days of receipt of the first submission for Priority 1 works;
- c) Final submission for Priority 1 works - within 7 days of receipt of the Engineer's comments;
- d) Provided all the Engineer's comments have been addressed, approval of the final submission will be given by the Engineer within 7 days; and
- e) For Priority 2 and 3 works the following durations shall be substituted for the above periods as stated in the table below:

**TABLE 1/2
PROGRAMMES FOR METHOD STATEMENTS**

	PRIORITY 2	PRIORITY 3
First submission	56	84
Comment by the Engineer	28	56
Final submission	14	14
Engineer's Approval	14	14

To facilitate approval - of the Method Statement the Contractor shall engage in discussions with the Engineer's staff during development of the Method Statement.

Work on Site may not commence until the following MMSs have been approved by the Engineer:

**TABLE 1/3
INITIAL METHOD STATEMENTS REQUIRED**

MMS 1	Occupational Health and Safety
MMS 2	Environmental Management and Protection
MMS 3	Quality Assurance
MMS 4	Employment
MMS 5	Preferential Procurement
MMS 7	Subcontractor, Supplier and Service Provider Management

PART C3.1 - SPECIFICATION

MMS 9	Construction Planning and Scheduling
MMS 10	Construction Management and Supervision
MMS 13	Security
MMS 14	Communication
MMS 15	Equipment Management
MMS 16	Site Accommodation and Transport
MMS 17	Site Establishment
MMS 18	Social Management and Public Relations
MMS 19	Access Control
MMS 20	Socio-Economic and Enterprise Development
MMS 21	Socio-Economic and Skills Development
CMS 15	River Diversion
CMS 16	Jet Grouting

Construction or manufacturing work on any aspect / component / part of the Works requiring a CMS shall not commence without such a CMS, approved by the Engineer.

Modifications may be required to the approved Method Statements from time to time. In such an event:

- The Contractor may propose modifications for the Engineer's approval; and
- The Engineer may give notice to the Contractor of modifications required to ensure the contents of the Method Statement comply and continue to comply with the Contract and the Contractor shall within 14 days of such notice submit a revised Method Statement to the Engineer for approval.

If any equipment, appliances, types or quality of Temporary Works are in the opinion of the Engineer, either unsafe or unsuitable for accurate and efficient construction, the Contractor shall replace or modify the item or items concerned without any additional payment.

Any approval, consent, acceptance, agreement, review, etc., by the Engineer (under this Clause or otherwise) shall not relieve the Contractor from any obligation or responsibility under the Contract.

1.10.1.2 Contractor's Documents for Designs

Where a variant or alternative design is initiated by the Contractor or he is required to design a part of the Works, he shall be responsible for timely obtaining any required design criteria from the Engineer as necessary and for the submissions of full design proposals, drawings and cost impacts or implications for the Engineer's consideration.

1.10.2 Quality Management

1.10.2.1 System and Procedures

The Contractor shall be responsible in terms of the Contract for the quality and testing of materials, workmanship and production processes in fulfilment of the Contract. To this end the Contractor shall establish, document, implement and maintain a Quality Management System based on ISO 9001.

PART C3.1 - SPECIFICATION

The Quality Management System documentation shall include as a minimum:

- a) Documented statements of a quality policy and quality objectives;
- b) A quality manual;
- c) Documented procedures;
- d) Documents needed to ensure the effective planning, operation and control of processes; and
- e) Records.

As part of the documentation needed to ensure the effective planning, operation and control of processes, the Contractor shall also institute and operate a Project Quality Plan (specific to the Contract) and complying, as a minimum, with ISO 10005.

The Contractor's Project Quality Plan (MMS1) shall specify which processes, procedures and associated resources will be applied by whom and when, to meet the requirements of the Contract. The contents of the Project Quality Plan shall detail as a minimum the following in order to satisfy the Specification relevant to each operation required for the execution of the Works in accordance with the Contract:

- a) Scope;
- b) Project Quality Plan Inputs;
- c) Quality objectives;
- d) Management responsibilities;
- e) Control of documents and data;
- f) Control of records;
- g) Resources;
- h) Requirements;
- i) Customer communication;
- j) Design and development;
- k) Purchasing;
- l) Product and service provision;
- m) Identification and traceability;
- n) Customer property;
- o) Preservation of product;
- p) Control of non-conforming product;
- q) Monitoring and measurement;
- r) Audits;
- s) Testing and reporting of testing;
- t) Review, Approval and Integration of Subcontractor Project Quality Plans; and
- u) Control of Method Statements, including Subcontractor Method Statements.

1.10.2.2 Acceptance of Quality Management System and Project Quality Plan

The preliminary Quality Policy Manual and preliminary Project Quality Plan included in in the tender document shall be supplemented and elaborated to fully detailed manuals and plans under the headings given in Clause 1.10.2.1 above, making use wherever possible of diagrams, charts, organograms, etc., in preference to lengthy descriptions.

The Contractor shall require Subcontractors to submit, for his approval, Project Quality Plans, at minimum, based on the headings required by ISO 10005 and the Contractor's Project Quality Plan. The Contractor shall include these Project Quality Plans, clearly indicating his approval, in his Project Quality Plan (ISO 10005).

1.10.2.3 Materials and Goods

(a) Proprietary Brands

Where the Specification refers to materials of a particular brand name the Contractor may offer an equivalent for the Engineer's approval but the Engineer is under no obligation to accept the alternative and no claims will be entertained if the alternative is not accepted.

(b) Testing of Materials

Unless stated otherwise, all testing shall be carried out and interpreted in strict accordance with the methods specified in the relevant Standards (South African, British, American, etc.). Testing and design work required in terms of a Specification may only be carried out by independent testing laboratories that are SANAS Accredited (as being ISO 17025 compliant). The Contractor may propose other testing laboratories to the Engineer for consideration. Use of any laboratories will be subject to the Engineer's approval.

(c) Quality of Materials and Samples

When required by the Engineer, the Contractor shall furnish all information on the materials to be used in the Works and shall provide to the Engineer such other particulars as he may require.

Before placing any order for materials to be incorporated into the Works, the Contractor shall submit to the Engineer for information, the names of the suppliers supplying the materials providing, such details as the origin, manufacturer's specification, quality, weight, strength, description and the like. When requested, the Contractor shall provide samples, information and manufacturer's test certificates of the materials to be incorporated into the Works. The samples ordered or specified shall be delivered to the Engineer on Site, allowing sufficient time for the Engineer to inspect and/or test the samples before the material is required in the Works.

Unless otherwise specified or instructed by the Engineer, all materials shall be used and placed in strict accordance with the relevant manufacturer's instructions.

1.10.2.4 Competence of Workmen

The competence of personnel required to undertake operations involving particular skills affecting the quality of the Works, such as compaction of pipe backfill, joint welding, lining and coating application to joints and repairs, etc. shall be demonstrated to the Engineer by means of tests arranged by the Contractor. Should the competence of any member of the Contractor's workforce

PART C3.1 - SPECIFICATION

be in doubt, the Engineer may order any re-testing of that member he considers necessary at any stage throughout the Contract. Suitable means of identification of different skills and training levels of members of the workforce by way of badges or such like shall be instituted.

The Contractor shall allow for monthly training and re-training sessions for applicators, supervisors and inspectors on the application of the joint lining and coating repair material until instructed otherwise by the Engineer. The Contractor shall include his charges for these training sessions in the relevant Fixed Charge and Time Related Charge items in the Bill of Quantities.

Workmen shall only receive practical training on parts of the Works as agreed by the Engineer.

1.10.2.5 Inspection and Testing

The Contractor shall carry out sufficient inspection and tests to satisfy himself that all requirements of the Specification are being met and the results of inspections and tests shall be submitted to the Engineer in accordance with the Contractor's Project Quality Plan. The Engineer may carry out such further inspections and tests as he deems necessary and the results of the Engineer's inspections and tests will be made available to the Contractor if so requested.

Where the Contractor's or Engineer's inspections and tests reveal that the requirements of the Specification have not been attained, the Contractor shall, at his expense, rectify the work to the extent that it does conform with the Specification.

Whenever the regular period for carrying on work is to be changed, the Engineer shall be given notice in sufficient time (at least 28 days) to rearrange staffing for proper inspection. The Engineer shall be given notice of any other proposed changes to normal working times at the weekly progress meetings or as necessary to cope with emergencies.

As much testing as is practicable shall be carried out on Site, including trial, acceptance and routine testing to be implemented by the Contractor, and any other tests as instructed by the Engineer for any complementary investigations required from time to time during the course of the Contract.

1.10.2.6 Approved Inspection Authority (AIA)

The Contractor shall appoint an AIA as part of the Contractor's team for quality control of all welding and corrosion protection at the factories during manufacturing and on Site during the construction of the Works up to the issue of the Performance Certificate (including remedying of defects during the Defects Notification Period). The duties of the AIA shall also include quality control of general manufacturing aspects and hydrostatic testing at the factories.

The AIA shall be an accredited inspection authority in terms of the South African National Accreditation System (SANAS) and the company (or companies) proposed by the Contractor shall be subject to the approval of the Engineer. The AIA will also be responsible to sign off on the QCP hold points in the factories and on Site.

Although an AIA is appointed to independently monitor the quality of welding and corrosion protection in the factories and on Site, this shall not absolve the manufacturers and Contractor from the obligation to implement additional quality assurance programs for production purposes.

The Contractor shall be responsible for the testing of welding and corrosion protection of 100% of the field joints and to mitigate the risks of delays, the Contractor shall provide adequate welding and corrosion inspectors as part of the AIA team.

PART C3.1 - SPECIFICATION

The Contractor shall share the test results with the Engineer, and the Engineer will also have the right to instruct additional independent ad hoc testing as and when required.

The Contractor shall pay the AIA within seven (7) days after receiving payment from the Employer and the Engineer shall have the right to delay the approval by the Engineer of the subsequent Contractor's Payment Certificate(s) with the number of days exceeding the seven (7) days AIA payment AIA requirement.

The Contractor's charges for the AIA shall be deemed to be included in the Preliminary and General in the Bill of Quantities. It is a specific condition that, before any amounts will be included in any Interim Payment Certificate pursuant to Sub-Clause 14.6 in the Conditions of Contract, that the Engineer shall be satisfied with the following to ensure that the Works comply with the requirements in the Contract:

- a) The requisite number of inspectors for the AIA as well as supervision have been deployed in the factories and on Site;
- b) The qualifications, training, competence and experience of the inspectors are sufficient for the type of inspections to be performed; and
- c) The CV's of such persons.

The Engineer will have the right to instruct the Contractor to:

- Increase the number of inspectors if in the Engineer's opinion the number employed is not adequate; and
- Replace inspectors should their competence and performance not be satisfactory in the opinion of the Engineer The AIA shall report directly to the Contractor but will submit quality control reports in parallel and at the same time also to the Engineer.

The minimum qualifications of inspectors shall be:

- Welding Inspectors: SAIW (or equivalent approved by the Engineer) Level 2 Welding Fabrication qualification;
- Corrosion Inspectors: SAQCC (or equivalent approved by the Engineer) Level 2 or NACE (or equivalent approved by the Engineer) Level 2 Corrosion Protection qualification;
- Radiographic Evaluator: SAIW (or ASNT or equivalent approved by the Engineer) Level 2 with radiographic / dye penetrant evaluation qualification; and
- Supervisor: Will be responsible for overall quality co-ordination, management and auditing, interpretation of radiography, communication with the Contractor and the Engineer and with a minimum SAIW (or equivalent approved by the Engineer) Level 2 Welding Fabrication qualification.

However, it remains the Contractor's responsibility to ensure that the AIA team's size and competency are adequate to ensure the quality of the Work complies with the Contract requirements.

1.10.3 Contractor's Returns

Records and returns shall be reported to the Engineer in a format approved by the Engineer.

1.10.3.1 Weekly Returns

The Contractor shall keep accurate daily records detailing work carried out on the Works and shall submit them to the Engineer as a sequentially numbered weekly report prior to the weekly progress meeting or at such other times as the Engineer may require.

The records shall include the following information for each Part of the Works separately and for each Subcontractor separately (where applicable):

- a) Extent of work done to date by category, location and activity identification number from the Contract Programme;
- b) The numbers of each category of workmen and supervising staff by trade, activity and location;
- c) The numbers and types of Contractor's Equipment used, hours worked, idle or down for repair and availability and utilisation;
- d) Materials delivered by quantity, date, storage location and applicable test certificates / quality forms as specified;
- e) The time and duration of any significant delays or breakdowns of any of the Contractor's Equipment;
- f) Listing of any deficiencies or non-conformances and corrective action(s) undertaken;
- g) Any other events relevant to the progress of the Works with reference to the Contract Programme and its detailed activities and work packages;
- h) A list of information / instructions given and received and any conflicts in Drawings and the Specification;
- i) Information / instructions required from the Engineer;
- j) A list of quality assurance documents, procedures and records that were added, amended and/or updated;
- k) A list of OH&S information submitted in accordance with Section 2 requirements; and
- l) Weather and climate records.

The weekly report shall also summarise:

- a) The work performed;
- b) The work performed as referenced on the Programme; and
- c) Information / instructions required from the Engineer.

Notwithstanding the foregoing, the Engineer may employ members of his own staff to record some or all of the above data in addition to the Contractor's records. The Contractor shall also provide such further information as may be requested by the Engineer.

1.10.3.2 Monthly Progress Reports

The Contractor shall submit monthly progress reports in accordance with Sub-Clause 4.21 of the Conditions of Contract. The Contractor shall in addition to this requirement provide a list of all information submitted pertaining to Section 2 requirements.

1.10.3.3 Progress Photographs

The Contractor shall maintain a photographic record showing the progress of the Works at the various work fronts, borrow / spoil areas, construction establishment areas or any other related areas at a rate of at least one photograph per day of work in progress and recording, inter alia, the following:

- a) All areas where major structures are to be constructed, in their virgin state and after clearing and grubbing;
- b) Progressive photographs of all excavations and the materials encountered;
- c) Progressive photographs of the pipe laying operations, including the placement of selected materials and backfill;
- d) Progressive photographs of all formwork, reinforcement and concrete works;
- e) Progressive photographs of all borrow pits before, during and on completion of activities therein;
- f) Any structures, fence lines, public or private access roads encountered;
- g) Progressive photographs of all underwater activities and structures as may be practical;
- h) Record photographs of any ancillary structures;
- i) Progressive photographs of all mechanical and electrical installation works;
- j) Progressive photographs of all control and instrumentation installation works;
- k) Photographs of all incidents;
- l) Progressive photographs of the management of all incidents;
- m) Progressive photographs of all landscaping and rehabilitation activities;
- n) Any specific photographs requested by the Engineer; and
- o) Photographs of all completed structures.

Where directed by the Engineer, certain progress photographs shall be taken from a fixed location each month.

Electronic copies on a 500 GB external hard drive [in jpeg format taken with an 8-mega pixel (minimum) digital camera at a minimum resolution of 3000 x 2000] shall be delivered to the Engineer each month. One additional 500 GB external hard drive shall be available for the Contractor to record photographs while the Engineer download photographs from the other external drive submitted each month. The photographs will become the property of the Employer.

Photographs on the external hard drive shall be named and filed according to the structure outlined in Annexure 1/4 of this Section.

1.10.3.4 UAV / Drone Based Survey Records

The Contractor shall maintain a photographic record showing the progress of the Works at the various work fronts, borrow / spoil areas, construction establishment areas or any other related areas at a rate of at least one survey per week of work in progress of the total Site and recording the activities in Clause 1.10.3.4, where practical. The number of surveys could be amended by the Engineer, depending on the progress of the Works at a specific Part.

Refer to Section 5 – Survey and Setting Out.

1.10.4 Management Meetings

The Engineer may from time to time require the Contractor's Representative to attend management meetings in order to review progress and/or the arrangements for future work, or should the Engineer considers it necessary to facilitate the Works.

Such meetings shall include the following:

- a) Site Progress Meetings (refer Clause 1.9.7);
- b) Design or Technical Meetings;
- c) Commercial Management Meetings – more specifically handling all commercial and contractual issues;
- d) Measurement Meetings (refer Clause 1.15.4);
- e) Commissioning Meetings;
- f) Inter-contract liaison Meetings;
- g) Project Safety Meetings;
- h) Environmental Management Meetings;
- i) Social Management Meetings;
- j) Socio-Economic Management Meetings; and
- k) Sundry other meetings.

Meetings under items (a) to (c) above, will be held on the basis of one of each every second week and attendance by the Contractor is compulsory. These meetings may be held consecutively at the same venue, be combined into a single meeting or in other combinations as directed by the Engineer.

The Engineer shall record the business of management meetings and supply copies of the record to those attending the meeting and the Employer. In the record, responsibilities for any actions to be taken shall be in accordance with the Contract. No request to attend a meeting and nothing in the minutes of such meetings shall constitute a notice or communication as required under Sub-Clause 20.1 of the Conditions of Contract. Any such notice or communication shall be given strictly in accordance with Sub-Clause 20.1 of the Conditions of Contract and shall be issued separately.

1.10.5 Integration Management

The Contractor shall provide an experienced technical manager who shall be responsible for the integration management of the long lead procurement processes, the relevant Contractor's design processes, the manufacturing processes and the multi discipline installation and commissioning processes.

The integration management function responsibilities shall include, but shall not necessarily be limited to, the following:

- a) Integration of the Contractor's:
 - i) Multi-discipline design processes (mechanical, electrical and control and instrumentation);
 - ii) Multi-discipline procurement processes and programming processes;
 - iii) Multi-discipline manufacturing and installation and testing processes; and
 - iv) Multi-discipline commissioning and trial operation processes.

PART C3.1 - SPECIFICATION

- b) Liaison with the Engineer regarding the Employer's design;
- c) Integration of the Subcontractor contract management process;
- d) The integration manager shall be delegated the necessary authority to perform the integration functions; and
- e) The Contractor shall submit, within 28 days after the Commencement Date, a Method Statement with a detailed job description for the integration management function. The detailed job description shall identify the role of the integration manager as a functional position in an organogram also indicating the lines of communication.

1.10.6 Accommodation of Traffic

It is a requirement that the Works do not disturb the normal flow of traffic on public roads or compromise the safety of the general public. The use of public and private roads, traffic accommodation and the manner in which the work is to be carried out is to be addressed in the Contractor's Method Statements and Health and Safety Plan.

Where the Works or use of public and private roads may affect the safety or operation of pedestrians or traffic, the Contractor shall provide and maintain such traffic signs, barricades, warning lights and flagmen as are necessary. The Contractor shall be solely responsible for complying with the "South African Road Traffic Signs Manual, Volume 2, Chapter 13: Roadworks Signing" as published by the Department of Transport, as well as any Specification and/or requirements of the relevant statutory and local authority.

This activity shall be covered in a method statement compiled by the Contractor which shall be subject to the Engineer's approval.

1.10.7 Areas for Handling and Lay Down of Material

In order to mitigate the risk of damage to material during blasting operations and limit the extent of construction servitudes, lay down areas for pipes and other material have been provided as follows:

- At the construction establishment areas;
- Site designated for the Operational Reservoir which will not be constructed;
- Defined storage areas along the servitude;
- Borrow areas; and
- Spoil areas;

as shown on the Drawings. The Contractor shall not make use of any other areas.

1.10.8 Servicing during Defects Notification Period

Without limiting in any way the liability of the Contractor for remedying defects, the Contractor accompanied by the Engineer when deemed necessary by the Engineer, shall make regular quarterly visits to each installation during the Defects Notification Period to service the Plant. During these visits he shall make all adjustments and do everything necessary to ensure the proper running of the Plant.

After each servicing visit to the Site the Contractor shall submit to the Engineer a report on:

- f) The condition of the Plant and the servicing work carried out;

- g) Any adjustments which were made; and
- h) The degree to which operators have become conversant with the Plant.

The last servicing visit shall be carried out during the last week of the Defects Notification Period. During this visit the Contractor shall carry out full checks on the Plant to ensure that the alignment, clearances and any other settings are correct and he shall carry out any adjustments necessary.

The Contractor shall ensure that all adjustments to the Plant and remedying of defects are supervised to ensure compliance with the Contract requirements.

All cost related to servicing and remedying defects shall be included in charges and rates in the BoQ.

1.10.9 Mass Haul Planning for Pipeline Earthworks

1.10.9.1 General

The total length of pipelines (DN 900 to DN 1600) to be constructed under this Contract is approximately 142 km. The pipelines will be buried underground with a nominal cover of 1.0 m. Suitable material will be required for the bedding of the pipelines and for trench backfill. Unsuitable and surplus material resulting from the construction of the pipelines will have to be disposed of. Based on the access provided to borrow pits and spoil sites and the geotechnical information provided in Volume 3 Part C4.2 – Geotechnical Data, and any relevant detail supplied during construction, the Contractor shall minimise development of borrow pits and haulage of importing and disposing of material.

1.10.9.2 Material Haulage Adopted with the preparation of the Bill of Quantities

An assessment of the borrow pits, spoil sites and material haulage was prepared by the Engineer and the Bill of Quantities is based on the results of this assessment – refer to Volume 3 Part C4.3 – Technical Memoranda for the assessment. Mass Haul Diagrams (MHD's) are included with the assessment. Such MHD's will be designated the "Tendered Mass Haul Diagram" and in accordance with Clause 1.10.1.1 shall form the basis of the Contract Mass Haul Diagrams developed and maintained during construction pursuant to Clause 1.10.9 unless information to the contrary was submitted by the Contractor during tendering and accepted by the Engineer.

1.10.9.3 Geotechnical Investigation

Geotechnical investigations were carried out to identify sufficient volume of suitable selected backfill material and where possible at 5km intervals. A number of borrow pits and spoil areas have been identified that can be utilised to provide pipe bedding and trench backfill materials and that can be utilised for disposing surplus and unsuitable material from the pipeline trench. The results of the investigations into the quality and quantity of the construction materials are provided in Volume 3, Part C4.2 – Geotechnical Data. The locations of the various borrow pits and spoil areas are shown on the Drawings.

1.10.9.4 Mass Haul Planning

The Contractor shall prepare a detailed Mass Haul Diagram to ensure that borrow pits and spoil areas are utilised efficiently, to make effective use of the borrow pit materials and suitable materials from the trench excavation to minimise the quantity of material hauled and borrow pits developed.

The Contractor shall undertake at least the following in his mass haul planning:

- a) He shall check the definition of the rock/hard excavation as per Section 5.
- b) He shall assess and confirm the ground level survey. (Refer to Section 5).
- c) He shall review the designed trench cross sections (payment line) from a side slope stability point of view and calculate the different excavation volumes. These volumes include top soil, fertile soil, suitable main backfill, suitable selected backfill and material unsuitable for backfill and surplus material. The volumes calculation shall be presented as solid volumes (bulking allowance to be made by Contractor when planning equipment utilisation).

The detailed Contract Mass Haul Diagram to be submitted in terms of Clause 1.10.9 shall be an update and expansion of the Tendered Mass Haul Diagram. Requirements of and supporting data/information required with the Contract Mass Haul Diagram and any updates thereto include the following:

- a) Each element of the pipelines i.e. Low Lift Rising Main, High Lift Rising Main and Gravity Pipeline;
- b) For each borrow pit, the start and end chainages along the pipeline route for which:
 - i) Bedding material is sourced;
 - ii) Backfill material is sourced;
 - iii) Associated volumes (bulked and in place in borrow pit and in pipe trench); and
 - iv) Associated km volumes for material hauled.
- c) For each borrow pit and spoil site, the start and end chainages along the pipeline route from which:
 - i) Hard excavation material is spoiled;
 - ii) Soft excavation material is spoiled;
 - iii) Associated volumes (bulked and in place in borrow pit/spoil site and in pipe trench); and
 - iv) Associated km volumes for material hauled.
- d) A summary table shall be submitted reflecting:
 - i) Total volume selected backfill exported from BP's (Bulked and in place);
 - ii) Total volume main backfill exported from BP's (Bulked and in place);
 - iii) Total volume hard material imported and spoiled to BP's (Bulked and in place);
 - iv) Total volume unsuitable or surplus soft material imported and spoiled to BP's (Bulked and in place);
 - v) Total volume hard material imported to Spoil Areas (Bulked and in place);
 - vi) Total haulage of selected backfill exported from BP's (Bulked and in place);
 - vii) Total haulage of main backfill exported from BP's (Bulked and in place);
 - viii) Total haulage of hard material imported and spoiled to BP's (Bulked and in place);

PART C3.1 - SPECIFICATION

- ix) Total haulage of unsuitable or surplus soft material imported and spoiled to BP's (Bulked and in place); and
- x) Total haulage of hard material imported to Spoil Areas (Bulked and in place).

The summary totals shall reflect the totals per Portions and Parts of the Works and the totals for the whole of the Works.

- e) The units in which the mass haul calculation shall be undertaken are:
 - Volume - m³
 - Haulage - m³km
 - Haul distance – km
- f) In support of the Contract Mass Haul Diagram, the following shall be submitted or revised, as the case may be:
 - i) Calculation of bulking factors;
 - ii) Distance from borrow pit to pipeline;
 - iii) Distance along pipeline; and
 - iv) Distance from pipeline to spoil area.

The Contractor shall not be permitted to commence with borrow and excavation operations for the pipelines before the Engineer has approved the relevant detailed Method Statements (H 18: Mass Haul Planning of Pipeline Material and H 19: Borrow Pit Management).

1.10.9.5 Mass Haul Maintenance and Progress Reporting

During the execution of the Contract the Contractor shall comply with the following minimum requirements for Contract Mass Haul Diagram maintenance and progress monitoring:

- a) The Contractor shall submit a revised mass haul diagram whenever:
 - i) The current mass haul diagram is inconsistent with actual material usage; and
 - ii) The Contractor proposes to significantly change, in the opinion of the Engineer, work methods, Method Statements, equipment, materials or manpower related to the current mass haul diagram.
- b) All variances from the Mass Haul Diagram shall be promptly reported to the Engineer and the future impact of such variations shall be determined and analysed by the Contractor and submitted to the Engineer.

The Contractor shall include a copy of the latest mass haul diagram with his monthly progress reports.

1.10.10 Integrated Cathodic Protection (CP)

The Permanent CP is a secondary corrosion protection system largely dependent on the integrity of the pipe coating being the primary corrosion protection system. The Contractor is responsible to deliver an operational CP system that relies on the successful integration of the primary and secondary corrosion protection systems. The Contractor shall protect the integrity of the pipe coating during all construction activities required as part of the Contract.

1.10.11 Interfaces with Existing Infrastructure

The detail of the Points of Supply (Off-Takes) are indicated on the Drawings.

The Contractor shall identify existing services such as pipeline, power cables, telecommunication cables, etc. on the complete Site and ensure that such services are not damaged where the Works intersects with such services. The Contractor shall for this purpose ensure that markers and beacons associated with such services be maintained at all times with a view to avoid incidents of damage to these services.

1.10.12 River Diversion

The design and construction of Temporary Works is the sole obligation of the Contractor. Due to the complexity of the Vlieëpoort Weir and Low-Lift Pumping Station founding conditions and the constraints imposed by the narrow river constriction at Vlieëpoort, the Employer provided a possible approach to the staged construction of the river diversion for information only.

A separate River Diversion BoQ is provided for this purpose under PART B1.2 of the BoQ. This provides a breakdown of the key elements of the temporary River Diversion works to facilitate the pricing thereof.

The Contractor has two options here:

- Option 1: Adopt and refine the Employer's conceptual design, or
- Option 2: Provide an alternative design.

Both options require the Contractor to accept full responsibility for the design and construction of the temporary river diversion works. The Contractor shall also provide proof of insurance for this.

1.11 SOCIAL MANAGEMENT AND SOCIO-ECONOMIC DEVELOPMENT REQUIREMENTS

The Employer is committed to the stimulation and promotion of economic development in the Project area in a targeted and focused manner with respect to both individuals and business entities and those directly affected by the Project. The Employer's objectives and the Contractor's obligations in this regard are stated in Sections 3 and 50.

Principally all communication with external parties regarding environmental management will be via the Employer. However, the Contractor will be required to develop a grievance mechanism / procedure in alignment with the Employer's Grievance Resolution Procedure to deal with complaints raised by external parties. The Contractor must keep a register of all complaints received together with the following records:

- a) Date and time of complaint;
- b) The method by which the complaint was made, e.g. telephone, letter, meeting, etc.;
- c) Name, town, contact telephone number of complainant. If no such details were provided, a note to that effect should be provided;
- d) Details of complaint;
- e) Action taken in response including follow up contact with the complainant;
- f) Any monitoring to confirm that the complaint has been satisfactorily resolved;

PART C3.1 - SPECIFICATION

- g) If no action was taken, the reasons why no action was taken; and
- h) Appropriate photographic records to be provided by the Contractor where relevant.

The Grievance Procedure will indicate the process of escalating grievances from the Contractor to the EM and Engineer to the Employer, and the way these are reported in the monthly progress reports.

Feedback on how grievances have been addressed must be provided to the party reporting the grievance.

1.12 OCCUPATIONAL HEALTH AND SAFETY

It is a requirement of the 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 health and safety hazards. The occupational health and safety requirements are specified in Section 2 – Occupational Health and Safety.

1.13 ENVIRONMENTAL REQUIREMENTS

1.13.1 General

Environmental management on the project is concerned not only with the final results of the Contractor's operations to carry out the Works, but most importantly with the manner in which his operations are carried out. It is thus a requirement that the Contractor shall comply with the environmental requirements on an on-going basis. The environmental requirements are specified primarily in Section 4 – Environmental Management. However, in addition to those stated above, environmental requirements applicable to the specific works are also specified in the relevant Specification Sections.

General environmental requirements during the remainder of the project life-cycle include the following:

- a) The design needs to consider and incorporate environmental requirements and sensitive environmental features;
- b) Where practicable and economical, develop designs to compliment the natural surroundings in order to preserve a sense of place (e.g. facade detailing of pumping stations to blend the structures with the natural environment);
- c) Define and communicate roles and responsibilities for the implementation of the CEMPr;
- d) Undertake negotiations and confirm arrangements with landowners and/or land users regarding:
 - i) Use of all private roads, with associated traffic arrangements;
 - ii) Land occupancy (construction facilities and temporary infrastructure);
 - iii) Domestic animals (avoiding impacts to livestock);
 - iv) Wildlife;
 - v) Protocol for lodging complaints;
 - vi) Possible loss of access;

PART C3.1 - SPECIFICATION

- vii) Existing structures and infrastructure (including temporary and permanent water management structures and infrastructure);
 - viii) Fencing and gate dimensions for traversing servitude;
 - ix) Traversing patterns of game and/or livestock;
 - x) Access to game and/or livestock drinking points;
 - xi) Security;
 - xii) Opening and closing of gates and access to private property; and
 - xiii) Claims procedure for damage to property and assets (include game and livestock).
- e) Prior to construction, ensure that all existing structures within the construction area are identified and recorded;
 - f) Properties may not be accessed for construction purposes unless consent has been granted by the landowner, or until the land acquisition process has been concluded;
 - g) Construction activities need to be planned and coordinated in consultation with the affected farmers in order to minimise impacts on land use (including crop production, ecotourism, game-farming, etc.);
 - h) Project components to avoid watercourses, as far as possible and where not possible subject to relevant approvals, with suitable buffers (minimum of 32 m) and mitigation measures in place. The sensitivity of the Matlabas river is of specific relevance; and
 - i) Implement the mitigation strategy for species of conservation significance, as contained in the EIA.

1.13.2 Project Specific Requirements

1.13.2.1 Bat Cave

Refer to the Bat Cave Risk Assessment Baseline Study. To avoid disturbing bats when they are active, in particular at dusk, in the late evening, and pre-dawn, construction activities shall be restricted to daylight hours. Refer to Section 4 for more detail.

1.13.2.2 Nests of Resident SCC Raptor Species

Refer to the Avifauna Baseline Study. The Contractor shall conduct the earth-moving and high intensity impacts (e.g. excavation and blasting) during autumn through early winter (February-May) near nests of resident SCC raptor species (e.g. Black Eagle, Verreaux's Eagle and Secretary Bird).

Construction near nests of resident SCC raptor species shall not be allowed from June to December (eggs laid in June-July with a nestling period 2.5-4 months).

Construction near nests of SCC breeding migrants (e.g. Wahlberg's Eagle) shall not be allowed from August to January (egg laying peaks September- October, nestling period 2-3 months)." Refer to Section 4 for more detail.

1.13.2.3 Fences around construction establishment areas

All fences around all construction establishment areas shall be clad with black 80% shade cloth.

1.13.2.4 Netting over Stock Piles

Camouflage netting to be draped over stockpile areas and temporarily secured with pegs where stockpiles are situated next to main roads or close to homesteads and within view of tourist accommodation.

1.13.2.5 Colours

Buildings and steel roof sheeting shall be painted with darker colours such as khaki brown, grey brown or olive green and light colours like red, blue and orange must be avoided.

The use of highly reflective material shall be avoided, and any metal surface shall be painted to fit into the surrounding environment in a colour that blends in effectively with the background.

White structures shall be avoided as these will form a significant contrast with the natural surroundings.

The Contractor shall obtain the approval of the Engineer for all colours.

1.14 STANDARDS, DRAWINGS AND CORRESPONDENCE

1.14.1 Standard Specifications

All references in the Specification to specific standard specifications such as British (BS), American (ASTM, AASHTO, AFS, etc.), French (AFNOR), German (DIN), and South African (SANS) and the like shall, unless otherwise stated, be deemed to refer to the latest edition of, or amendment to, the standard specification which was published by the Base Date.

The Contractor may propose standards other than those specified, but shall demonstrate to the satisfaction of the Engineer their equivalence with those specified.

In the event of conflict between the specific standard specifications and the provisions of the Contract, the provisions of the Contract shall prevail.

1.14.2 Drawings and Co-ordination

The Tender drawings issued with the Tender Documents are of a general nature only but are considered to be sufficient for the purpose of tendering. Tender drawings are not to be used for design or construction, or for ordering of materials.

Additional and modified drawings will be issued by the Engineer to the Contractor for purpose of construction and the Contractor's design. Such Drawings will be issued in accordance with the Drawing Issue Schedule provided for in Clause 1.9.5 d) and with due consideration of the programme of manufacture and construction after co-ordination with the Contractor. In particular, the Contractor shall indicate in the Drawing Issue Schedule the lead times for critical Drawings.

Where the Contractor's Equipment and Temporary Works or Plant may have an effect or impose forces on any part of the Permanent Works the Contractor shall, after co-ordination with the Engineer and having due regard for the dates given in the Drawing Issue Schedule, timely submit a Contractor's Document giving all necessary details for incorporation into the detailed design and Drawings of the Works. Such details shall include the magnitude and direction of such forces, interaction analyses, certified foundation designs / drawings and any other special construction requirements.

1.14.3 Correspondence to the Engineer

All correspondence from the Contractor to the Engineer shall address only one main topic in each correspondence item. Correspondence shall be dated, sequentially numbered and distributed in accordance with a procedure agreed with the Engineer as provided for in Clause 1.10.2.

1.15 PRINCIPLES OF MEASUREMENT AND PAYMENT

1.15.1 Bill of Quantities and Prices

In the Bill of Quantities (BoQ) the headings and abbreviated item descriptions identify the work covered by the respective items and shall be read in conjunction with those clauses contained in the Measurement and Payment parts of the various Specification Sections and named in the Payment Reference column of the BoQ.

The BoQ has been drawn up to provide separate items for fixed, time-related, quantity proportional charges (where applicable) as well as provisional items (including Dayworks) and all the Contractor's rates and prices shall be separated into these categories.

The quantities of work and material set out in the BoQ are estimated quantities set against abbreviated item descriptions. Only actual quantities will be measured for payment and for computation of the final Contract Price, in accordance with the Specification and Drawings. Quantities may be increased or decreased during the course of the Contract as provided for in the Conditions of Contract.

The items listed in the BoQ comprise the total of all items intended for use in effecting payment for the Works and no payment will be made for any item not listed as a payment item or not shown and/or listed in the BoQ, other than as provided for in the Conditions of Contract. The Contractor shall be deemed to have taken due care in pricing the BoQ and, even where he has not priced separately and explicitly such items that in his opinion have been omitted, he shall be deemed to have made due allowance for such items in his rates and prices.

1.15.2 Payment Item Descriptions

The descriptions given in the Measurement and Payment clauses of the various Sections of the Specification for the payment items indicate the work to be allowed for in the rates and prices for such payment items and do not necessarily repeat all the details of work and materials required by and described in the Specification and the Drawings. Therefore, the nature and extent of the Works are to be ascertained by reference to all the various documents comprising the Contract. Where Clause references are contained in item descriptions, these are given for guidance only and are not necessarily correct and exclusive to other relevant provisions of the Contract. It shall be the responsibility of the Contractor to verify the correctness and inclusiveness of these references.

Except where otherwise specified in the Measurement and Payment clauses, the measurement of work shall be computed net from the dimensions given on the Drawings.

1.15.3 Prices to be Inclusive

The rates and prices in the Bill of Quantities shall take precedence over any prices presented elsewhere in the Contract (e.g. in Returnable Schedules) and shall represent full compensation for

PART C3.1 - SPECIFICATION

executing and completing the work as specified or implied in the Contract. Unless stated otherwise, this will include, but not be limited to:

- a) General obligations, overheads, liaison, liabilities and risks involved in the proper management and execution of the Works as set forth in or reasonably to be implied from the Contract;
- b) All taxes, duties, surcharges, royalties and the like payable by the Contractor;
- c) Complying with the Specification, Contract Conditions and other Contract requirements;
- d) All testing and quality control and supplying results of tests carried out by the Contractor to the Engineer. Attendance and transport for sampling and testing carried out by the Engineer;
- e) Design, drawing and documentation for all Parts of the Works designed by the Contractor such as [but not limited to] Mechanical, Electrical and Control and Instrumentation Plant and documentation for all Parts;
- f) Preparation and timely supply of detailed working drawings as applicable;
- g) Preparation and timely supply to the Engineer of all the specified records of the Works;
- h) The effect on the planning and programming of the Works;
- i) Labour and supervision;
- j) The procurement and supply of materials and goods including purchase, loading, transport, delivery to and handling at Site, storage and eventual delivery to and handling at the point of construction, and the incorporation in the Works, taking delivery of materials and goods supplied by others, handling, storage and incorporation of materials and goods into the Works;
- k) The extraction of natural material from borrow areas including the specification and/or approval of quality of such material, identification and demarcation of borrow areas, loading and transport of such material to the Works;
- l) Spoiling of excess material at designated spoil areas;
- m) Processing of goods and materials as specified and as necessary and incorporation in the Works as specified such that the Works will be fit for the purpose for which they are being provided;
- n) Contractor's Equipment supply and utilisation;
- o) Temporary Works and infrastructure requirements including the construction of sumps, furrows, drains, cofferdams, measuring weirs, settlement ponds, oil separators, slurry trenches, cut-off trenches and any other Temporary Works as may be necessary for the construction of the Works in accordance with the Contract;
- p) Waste;
- q) All Tests on Completion, maintenance and remedying of defects during the Contract, including during the Defects Notification Period;
- r) Profits; and
- s) All other incidentals necessary for the completion of the work and maintenance thereof.

Where the Contractor has priced an item as "nil" or "0-00" it will be deemed that no charges are or will be incurred against such an item. In the event of no price having been entered against any item, the rate, price or sum will be deemed to be "nil" or "0-00". If the Contractor has not specified items where required to do so, the work will be deemed to be covered by the rates and prices elsewhere and no additional payment will be considered.

The Bill of Quantities shall not form the basis on which the Contractor orders materials for the construction of the Works. Responsibility for the accuracy of quantities of materials ordered shall be solely that of the Contractor.

1.15.4 Measurement Meetings

Pursuant to Clauses 12 and 14 of the Conditions of Contract and Clause 1.10.4 of this Section 1, the Contractor shall attend monthly meetings with the Engineer where all matters concerning measurement and payment will be discussed. The Contractor shall submit for the meeting a monthly statement together with all calculations and supporting data in substantiation of any measurements undertaken and any additional payments claimed for work done and/or time expended during the previous month pursuant to Clause 20 of the Conditions of Contract.

1.15.5 Bill of Quantities Structure

The structure of the BoQ has been set out to fulfil the following main objectives:

- a) To enable the Contractor to provide in reasonable detail the separate charges in respect of his general contractual, supervisory, overhead and organisational obligations, as well as the charges associated with office and accommodation facilities, establishment, Contractor's Equipment, Temporary Works, and the like.
- b) To categorise the items for the obligations as referred to in a) above so as to provide the Contractor the opportunity to provide the charges associated with each item in such a way as to facilitate evaluation, assessment and determination of the effects on these obligations of changed conditions provided for under the Conditions of Contract for which the Employer is responsible, inter alia:
 - i) Changes in measured quantities in the "quantity proportional" (where applicable and as hereinafter defined) items under the Parts of the BoQ other than the Preliminary and General sections of the BoQ;
 - ii) Variations, in accordance with Clause 13 of the Conditions of Contract;
 - iii) Changes to physical conditions encountered that are unforeseeable, in terms of Sub-Clause 4.12 of the Conditions of Contract;
 - iv) Extensions of time in accordance with Sub-Clause 8.4 of the Conditions of Contract;
 - v) To enable the Contractor to identify separate charges as may be appropriately applicable to the civil, mechanical, electrical, cathodic protection, control and instrumentation, security systems and wireless communication work elements; and
 - vi) To provide the Contractor the opportunity to balance his prices such that, where "quantity proportional" (as hereinafter defined) rates in the BoQ are applicable to items subject to re-measurement of quantities, such prices are appropriate to the nature of the item, i.e. that the prices can be deemed proportional to the quantities or sizes or scope required for the item.

The Contractor may include such additional items (or break down any items) where this is allowed for in the Preliminary and General sections of the BoQ as he deems necessary, should he consider that these objectives and/or normal payments will better be served thereby. Where utilised, such items shall be fully described and completed in a similar manner to the preceding billed items, provided that such additional items will be deemed not to alter any principle embodied in the provisions of this Section and especially in any provision of this Clause 1.15.

PART C3.1 - SPECIFICATION

The Employer may, within 28 days of the Commencement Date, require the Contractor to re-distribute money within the Accepted Contract Amount to ensure the facilitation of the objectives. Such re-distribution shall be undertaken:

- a) In consultation with the Engineer;
- b) With reference to any Employer's requirements for balanced and/or minimum pricing; and
- c) With reference to the basis of the Contract, inter alia as may have to be established from the tender documents in escrow under Sub-Clause 12.5 of the Conditions of Contract.

The Contractor shall submit the re-distribution to the Engineer within 28 days of the Employer's request, which shall be in the form of a revised BoQ in electronic and hard copy formats, subject to the approval of the Engineer within 28 days of the Contractor's submission.

1.15.5.1 Types of Charge

The items in the BoQ have been categorised to allow for the following different types of charge:

(a) Fixed Charge

A charge for a scheduled item which is deemed to remain unaltered throughout and which is deemed to be expended and due following the fulfilment of the requirements under the item, irrespective of any time duration or any quantity measured (i.e. the sum is unalterable but may be progressively certified as permitted under Clause 1.15.7.1).

(b) Time-Related Charge

A charge for a scheduled item which is deemed to be expended and due in linear proportion to the time expended in the execution of the work or service or obligation or applicable resource allocation in relation to the total length of programmed time duration provided for that item.

(c) Quantity-Proportional Charge (where applicable)

A charge that is deemed to be expended and due in linear proportion to the length, area or volume of work executed, the quantity of material, number of articles supplied, services rendered, or applicable resources (see Clause 1.15.12, manpower, Temporary Works) provided, etc., as defined by the unit scheduled for the item. The quantity-proportional charges generally comprise the re-measurement items of the Contract and the rates shall be deemed fixed for all quantity changes, subject to Sub-Clause 12.3 of the Conditions of Contract.

Provided that, for the above categories of charge (a) to (c):

- a) Where there is no statement to the contrary a rate for an item shall be deemed to be a quantity-proportional charge; and
- b) Where the Conditions of Contract prescribe financial compensation for an event for which the Employer is responsible, on the basis of Cost, compensation actually determined on the basis of the above categories of charge (which all include profit elements), shall be reduced by reference to the deemed profit element in Sub-Clause 1.2 of the Conditions of Contract. Such reduction shall be deemed to satisfy the definition of Cost (which excludes any profit element).

(d) Provisional Amounts

Where required, Provisional Sum items have been included in the Bill of Quantities, as provided for in Sub-Clauses 1.1.4.10 and 13.5 of the Conditions of Contract. This includes a Daywork Schedule containing provisional items for Daywork in accordance with Sub-Clause 13.6 of the Conditions of Contract.

1.15.5.2 Item Categories

The Preliminary and General charges have been grouped in the various parts of the BOQ under three separate categories comprising General Items, Equipment Items and Other Items as indicated below:

(a) General Items

These are items related to the Contractor's general obligations under the Contract in respect of contractual, overhead, supervisory, organisational, office and accommodation facilities and establishment requirements for the execution of the Works. General items may be provided for the duration of the Contract or a part thereof and may also be provided for the Works in general or a particular Part of the Works.

General Items are divided into three groups:

- a) Primary General Obligations: Items included in Parts A of the BoQ, which are deemed to be required for the full duration of the Time for Completion until the issue of the Taking-over Certificate for the whole of the Works and as applicable, the Defects Notification Period;
- b) Secondary General Obligations: Items included in Parts other than Part A of the BoQ, which are associated with a Part of the Works (as hereinafter defined) or specific operations, being executed in programme durations generally shorter than the Contract period; and
- c) Facilities: Items which relate to facilities, such as office and accommodation facilities, services, assistance, equipment, etc., provided for the use of the Employer, the Engineer or the Contractor as appropriate. These items may be related to the Works in general and therefore included in Part A of the BoQ, or with specific areas or operations or Parts of the Works, in which case they are scheduled in Parts other than Part A of the BoQ.

(b) Equipment Items

These are items of Contractor's Equipment, Temporary Works or both which may be required either for the execution of the Works in general and therefore included in Part A of the BoQ, or with specific areas or operations or Parts of the Works, in which case they are scheduled in BoQ Parts other than Part A of the BoQ. Equipment Items are divided into two groups:

- a) General Equipment: Items included in Part A of the BoQ, which are associated with the Works in general and required for the full duration of construction until issue of the Taking-Over Certificate for the whole of the Works or for programme durations that may be shorter; and
- b) Specific Equipment: Items included in Parts other than Part A of the BoQ, which are associated with specific areas or operations or Parts of the Works for programme durations shorter than the full duration of construction.

PART C3.1 - SPECIFICATION

(c) Other Items

These are items which do not fall into either of the above categories but are either specified or called for under this Section, or included by the Contractor in the appropriate places in the Bill of Quantities.

1.15.5.3 Parts and Portions of the Works

Where the term "Parts of the Works" is used in Clause 1.15 and/or in the BoQ, it shall mean a part or combination of Parts of the Works as defined by the Employer. Such Parts shall conform to the limits of construction as defined and/or as reflected in the measurement of relevant quantity-proportional Parts of the BoQ. Combinations of these Parts may be used in the relevant parts of the BoQ for areas requiring common resources. Refer to the Project Structure Diagram (Drawing 2A-P2-001) in Annexure 1/7 for the breakdown of Contracts, Parts of the Works and Sub-Parts of the Works.

Where Sub-Parts of the Works have the potential for significant variance of the estimated production rates based on the available information, such Sub-Parts may be further subdivided into portions exhibiting similar average production rates. Where the term "Portions" is used in Clause 1.15 and/or in the BoQ, it shall mean a Portion of a Part of the Works as defined by the Employer or the Tenderer in Schedule E.

Such Portions shall conform to the limits of construction as defined and/or as reflected in the measurement of relevant quantity-proportional Parts of the BoQ. Combinations of these Portions may be used in the relevant sections of the BoQ for areas requiring common resources. The following table reflects the Employer's Portions of the Works.

**TABLE 1/4
EMPLOYER DEFINED PORTIONS OF THE WORKS
PART B: ABSTRACTION WORKS:**

Description	Sub-Parts		Portion
Diversion Weir	B1		
Earthworks: Foundations		B1.3	
Conventional Jet Grouting			B1.3.3
Hammerhead Jet Grouting			B1.3.4
Relevant Secondary P&G's		B1.1	
Diversion Works and Low Lift Pumping Station	B2		
Civil Works		B2.1	
Earthworks		B2.1.3	
Conventional Jet Grouting			B2.1.3.3
Hammerhead Jet Grouting			B2.1.3.4
Relevant Secondary P&G's		B2.1.1	

1.15.6 Preliminary and General Items and Evaluation

1.15.6.1 Contractor to Price all Preliminary and General Items

The Contractor shall indicate a rate, price or sum against each item in Part A and the Preliminary and General sub-section of each part of the BoQ other than Part A. The Contractor shall not group items or Parts of Work together even if common resources are shared. The rates and prices entered against such items in Part A and the Preliminary and General sub-section of each part of the BoQ other than Part A shall take into account the sharing of resources as determined by the Contractor.

1.15.6.2 Fixed and Time-related Charges

The combined value of a fixed charge item (FC) and an associated time-related charge item (TRC) shall be the total payment due for the provision, operation and maintenance of the specified item (obligation, service, facility, resource, equipment group, etc.) required to execute the function, implied or otherwise by its provision, for the programme duration as inserted against the TRC item in the BoQ. This combined value shall also include the total payment due for final demobilisation and removal of the facility / equipment from Site and any associated reinstating or making good of the Site as specified.

The BoQ price for a FC item which has no TRC item which can be directly associated with it by description in the Preliminary and General items of the BoQ will be deemed to be the total payment due as described above, and vice versa.

1.15.6.3 Programme Durations and TRC Prices

The "Programme Duration" applicable to a TRC item shall be as inserted in the appropriate place in the TRC items and shall be the length of time or duration over which the item is deemed to be actively required for the purposes of the Works and over which the Contractor has spread his price for that item. Such durations shall cover the time required for the execution of the stated or implied function for which the item is provided or established and shall include any applicable time required for any pre-commissioning tests in accordance with Section 48. The programme durations for commissioning and trial operations shall be dealt with in the Bill of Quantities.

Where the programme results in time-related items that are discontinuous i.e. broken into a series of active durations separated by a period or periods of inactivity in a particular item, the individual durations of activity shall be summed and entered against the appropriate TRC item. Additional items may be added by the Contractor as provided for in Clause 1.15.5 of this Specification.

It is recognised that the durations in the BoQ will initially be based on the Tendered Contract Programme. However, when the Contractor prepares the Contract Programme, all durations for the TRC's in the BoQ and the overall durations for each Part of the Works shall be reviewed and brought into alignment with the programme durations in the Contract Programme. Such revised durations shall not alter the balance of the BoQ (being the value relationships between significant parts and/or items of the BoQ) nor the aggregate total value of the TRC's across all the various parts of the BoQ. No TRC resulting from a revised duration shall be more than 10% changed from that based on the equivalent duration derived from the Tendered Contract Programme. Any resulting shortfall or surplus in the total of a TRC sub-section of a part of the BoQ shall be resolved by altering appropriate prices for the TRC's in Part A of the BoQ, provided that the aggregate of all such adjustments (i.e. transfers between Part A TRC's and TRC's of other Parts of the BoQ) shall not exceed 5% of the TRC total in Part A of the BoQ.

1.15.7 Payment Principles for Part A – Preliminary and General

The following provisions constitute a specified method for the adjustment of the time and/or the level of resources required for or caused by changes in work (or changes to a group of items in a part of the Works) as provided for in Sub-Clause 12.3 of the Conditions of Contract.

1.15.7.1 Fixed Charge Items

The sum provided for each FC item will be authorised for payment in terms of the first certificate issued after the Contractor's obligations have, in the opinion of the Engineer, been discharged as far as that item is concerned.

Before any payment is certified under these items, the Contractor shall satisfy the Engineer that he has provided on Site systems, facilities and equipment of quality and size appropriate to their intended purpose and duration for the Works.

Provided that, where an item in Part A and the Preliminary and General sub-section of each part of the BoQ refers to a certain facility or item which is to be ultimately removed in terms of the Contract, payment will be made at the FC sum less 15%, which 15% will become due when the facility or item has been removed and the Site restored as specified and to the satisfaction of the Engineer.

Where a General, Equipment or other Preliminary and General Item comprises a number of lesser individual resources, or groups of resources that are complete in themselves and sufficient in the opinion of the Engineer to fulfil their intended purpose for the Works, the Engineer may certify the FC payment pro-rata to the value that such lesser resources (when actually established at the Site) bears to the value of the full resources of the item, less the 15% allowance for later removal.

Should the Engineer not be satisfied with the systems, facilities and/or equipment provided, or should the items provided not be in accordance with the Contract, or prove to be of inadequate capacity, he may reduce the amount of the FC's for such items to reasonably reflect the actual provision in relation to the relevant FC item until such time as the Contractor has provided satisfactory facilities and equipment, whereupon the full amount applicable will be reinstated. Such reduction will not prejudice the application of any other remedy under the Contract.

However, where, prior to the issuing of the Letter of Acceptance, the Employer and the Contractor had agreed that certain moneys in the Bill of Quantities would be redistributed thereby increasing the original tendered Sum for any FC item relating to facilities provided by the Contractor for the Engineer pursuant to Clause 1.7 then the following will apply:

Should the Engineer instruct the Contractor that:

- a) some of the facilities to be provided for the Engineer are not required at all; or
- b) such facilities are not required at the original intended location but a part of those facilities are required at an alternative location, then

notwithstanding the general provisions of this Clause, the Engineer shall certify for payment such part, or parts, of the relevant FC Sum(s) as is appropriate under the circumstances so as to satisfy the condition that the Contractor will not forfeit that part of the redistributed moneys referred to above by virtue of the Engineer's instructions in a) and b) above.

1.15.7.2 Time-Related Charge Items

Payment of the TRC sums will commence once the complete item or facility is, in the opinion of the Engineer, in beneficial operation for the execution of that stated or implied function for which it was provided or established.

Payment for TRC items will be certified by way of incremental amounts (calculated by the division of the TRC sum by the programme duration) in each of the subsequent progress certificates until the sums provided have been fully certified.

The TRC sum will not be varied for shorter or longer time durations for which the item or facility is actually employed, operated and maintained (except as provided for in Clause 1.15.6.3) provided that:

- a) In the case of early completion, any remaining amount of the TRC sum will be certified by the Engineer on completion of the relevant item;
- b) In the case of late provision, establishment, commencement of operation or Tests on Completion, only the incremental amount (calculated by dividing the TRC sum by the programme duration) will be certified per measurement period from the late start and then continue for the remainder of the duration of the item, after certification of the FC item, and not an increased incremental amount calculated by dividing the TRC sum by any shorter time period;
- c) In the case of the Engineer anticipating late completion of the function for which an item is provided (i.e. beyond the programme duration) the balance of the TRC sum remaining to be certified will be spread over the longer period to the anticipated completion of the item;
- d) In the case of the Engineer anticipating early completion of the function for which an item is provided (i.e. within a period shorter than the programme duration) based on consistent achievement of enhanced monthly progress rates, the balance of the TRC sum remaining to be certified will be spread over the shorter period to the anticipated completion of the item; and
- e) Notwithstanding the general provisions of this Clause the provisions of the final paragraph of Clause 1.15.7.1 shall apply mutatis mutandis to appropriate Time-Related Charge Items.

Where the unit of measurement against a Preliminary and General item is a time value (days, weeks, months, etc.) and not a "sum", certification will be made as a Quantity-Proportional Charge for the actual time period of the provision of that item as determined by the Engineer. No payment will be certified for additional periods for which the Contractor is held to be liable.

The only deviation, within the principles outlined above, will be in the event of the Contractor having submitted with his Tender histograms of the initial build-up and/or later run-down of the level of facilities or equipment to be provided under any item. In this case the TRC payments will be certified, (after certification of the relevant part of the FC item), pro-rata in proportion to the histogram levels, or at the discretion of the Engineer, as actually provided. Such distribution of the TRC will be taken into account in determining payment in respect of that item under any of the relevant clauses following.

1.15.7.3 Withholding of Payment

Should the Contractor fail to continue to provide or fulfil all or part of the services, obligations and liabilities required of him in a particular period in respect of any FC and/or TRC item, certification of payment for all or part of the relevant FC and/or incremental TRC amount for the respective items may be withheld until the required service, obligation or liability has been discharged.

Should the Contractor fail entirely to provide or fulfil for a period of time all or part of the continuing services, obligations and liabilities required of him in respect of a FC and/or TRC item the amount, or part of the amount for the item, which in the opinion of the Engineer fairly reflects such failure, will be omitted and the Contract Price reduced accordingly.

1.15.7.4 Quantity-Proportional Items

Certification of Quantity-Proportional items will be made by way of progressively measured quantities of the relevant items or work as discharged in accordance with the Contract and to the Engineer's satisfaction, applied to the relevant rate provided for that item in each subsequent progress certificate until the full quantity finally required has been discharged.

1.15.7.5 Increase or Decrease in Price

The amounts included in the BoQ in respect of Preliminary and General items shall be subject to increase or decrease in price applied in accordance with Sub-Clause 13.8 of the Conditions of Contract, subject to the limitations below.

When certification of a payment or part of a payment which has been withheld in terms of Clause 1.15.7.3 is subsequently effected, the price adjustment factors to be applied to the delayed amount shall be those factors which would have applied if certification had not been withheld.

1.15.8 Adjustment of TRC Sums

The Contractor's general charges and profits not included in the Preliminary and General items of the BoQ, will be deemed to be distributed throughout the items in the other Parts and sub-sections of the Bill of Quantities pro-rata to the value of each item respectively. Provided that any such charges so distributed will not be taken into account when assessing the effect of changes on the Preliminary and General items in accordance with this Clause 1.15.8.

Should the Engineer accept a change or extension to the duration of any Part of the Works, adjustments will be made to the programme durations only for such elements of the TRC's which, in the opinion of the Engineer, are affected by the accepted change or extension to the respective duration.

The accepted revised duration for a TRC item will be applied to the incremental TRC amount (previously calculated in accordance with Clause 1.15.7.2) or the applicable element thereof and a revised total TRC calculated. Any extra payment thus derived shall be the sole compensation for any increased charges (except the quantity-proportional charges) arising from the applicable cause of the change or extension to the respective durations.

1.15.8.1 Extension of the Time for Completion

In any claim for an extension of the Time for Completion of any Section (where applicable) or whole of the Works, the Contractor shall include with the fully detailed claim and the full supporting particulars required in terms of Sub-Clause 20.1 of the Conditions of Contract, an assessment of the time implications on the programmed activities resulting from the respective cause in compliance with the time impact analysis required in terms of Clause 1.9.6 e). Such analysis shall include both electronic and hard copies of the latest Contract Programme on which the time implications of the changed conditions, quantities or variation shall be clearly marked. The

PART C3.1 - SPECIFICATION

Contractor shall ensure that all relevant documentation as specified and as relating to the time impact analysis is submitted with such programme analyses.

Where changes or extensions to the durations applicable to Parts of the Works and/or their respective TRC's are accepted by the Engineer, such changes and/or extensions will, on completion of each Part of the Works and subject to Sub-Clause 20.1 [Contractor's Claims], be taken into account by the Engineer in assessing the Contractor's entitlement to an extension of the Time for Completion in accordance with Sub-Clause 8.4 of the Conditions of Contract.

However, it is to be noted that there is not necessarily any direct correlation between such Part / TRC duration changes and an extension of the Time for Completion, because the programme for the whole of the Works and/or Sections may comprise a combination of the durations of a number of individual Parts of the Works. Within a Section or whole of the Works therefore, an extension of one Part of the Works may be offset by a reduction in another, resulting in a different overall time effect on the Section or whole of the Works than may be evident from only one of the Parts of the Works on its own.

1.15.8.2 Reductions of Work

If a variation ordered by the Engineer under Clause 13 of the Conditions of Contract results in a reduction of the amount of work to be executed, or the amount of time required to execute the Works or Parts of the Works, the program duration for the applicable TRC item will be proportionally adjusted.

Where such variation applies to TRC items for equipment or facilities which have been provided, operated and maintained for the reduced time period, the TRC sum will be reduced in proportion to the reduction in duration but with due allowance being made for any actual under-recovery of time-related finance and insurance charges, etc. which may have been allowed for in the TRC sum. The Contractor shall submit proof of such under-recovery, if any, for consideration by the Engineer.

1.15.8.3 Varied Time-Related Rates of Payment

If the Contractor has submitted in terms of Clause 1.15.7.2 hereof distribution histograms of a TRC item, such histograms will be taken into account in determining the amounts due under this Clause 1.15.8.

1.15.9 Measurement and Payment for Specification Section 1

The rates and prices provided for the Preliminary and General items (FC's and TRC's) shall not include for the Quantity-Proportional and other charges provided under other Specification Sections and sub-section or parts of the Bill of Quantities.

The principles of measurement and payment applicable to the Preliminary and General items of the Bill of Quantities as set out in Clauses 1.15.5, 0, 1.15.7 and 1.15.8 are amplified below with more specific detail applicable to the various items or groups of items.

1.15.10 Fixed Charges**1.001 Primary general obligations****Unit: lump sum (Sum)**

Separate items are provided for the various aspects of the Contractor's primary general obligations, overheads, contract and construction management (head office and Site), supervision, training, etc., as applicable to the Contract in general.

The FC sums shall be full compensation in respect of the Contractor's FC for initiating the various aspects of the Contract, including financing, recruitment / mobilisation, establishment, setting up of systems and facilities, etc., as applicable for the timely and due fulfilment of the Contractor's respective initial obligations including for :

- a) Compliance in full with the Conditions of Contract as relevant to each item;
- b) Compliance in full with any details required in terms of the Specification, as relevant to each item;
- c) Payment of all salaries, wages and any duties and dues not specifically provided against the various work items; and
- d) Submission to the Engineer for approval and/or information such Contractor's Documents and others as are required or necessary to demonstrate that the obligation in respect of each item has been discharged by the Contractor.

Each item will be certified for payment after the following respective obligations have been fulfilled:

- a) Performance Security and Supplementary Performance Security (if applicable). Refer to the Conditions of Contract and Section 4: After the Security has been accepted by the Employer;
- b) Insurance and deductibles: After the Contractor has complied with his obligations pursuant to Sub-Clause 18.8 of the Conditions of Contract;
- c) Head Office Contract Management and Overheads: After the signing of the Agreement by the Contractor and Employer and the approval of the performance security by the Employer;
- d) General Site Supervision and Overheads: After 90% of the Contractor's key personnel of general overhead site management and supervision including back up and overhead staff and assistants have been fully mobilised on Site ready to commence work;
- e) Provide and maintain escrow services in terms of Sub-Clause 12.5 of the Conditions of Contract;
- f) Programming Requirements: After the approval by the Engineer of the Contractor's detailed programmes in terms of Clause 8.3 of the Conditions of Contract, as amplified in Clause 1.9 of the Specification and the establishment on Site of the programming team and equipment;
- g) Integration Management: After the requirements of Clause 1.10.5 have been complied with in full;
- h) Quality Management: After the detailed system as detailed in terms of Clause 1.10.2 has been approved by the Engineer and the Contractor has implemented the system for 28 days including having the required personnel on the Site;
- i) Submission and maintenance of Method Statements in accordance with Clause 1.10.1.1;
- j) Contractor's Returns: After implementation of a fully compliant system of records and returns in terms of Clause 1.10.3;
- k) Implementation and arrangements for management meetings in terms of Clause 1.10.4;

PART C3.1 - SPECIFICATION

- l) Socio-Economic Requirements: A number of separate FC items have been provided in the Bill of Quantities for Socio-Economic Requirements in compliance with Section 50 of the Specification. Each item shall only be certified for payment after the specified or implied requirement, has in the opinion of the Engineer, been discharged in full;
- m) Occupational Health and Safety: A number of separate FC items have been provided in the Bill of Quantities for Occupational Health and Safety compliance with Section 2 of the Specification. Each item shall only be certified for payment after the specified or implied requirement has in the opinion of the Engineer been discharged in full and confirmed by the Health and Safety Agent;
- n) Environmental Obligations: A number of separate FC items have been provided in the Bill of Quantities for Environmental Management Obligations in compliance with Section 4 of the Specification. Each item shall only be certified for payment after the specified or implied requirement, has in the opinion of the Engineer, been discharged in full;
- o) Competency training in terms of Clause 1.10.2.4;
- p) Provide and maintain escrow services in terms of Sub-Clause 12.5 of the Conditions of Contract; and
- q) Submission and maintenance of Mass Haul Planning in accordance with Clause 1.10.9.

1.002 Secondary general obligations**Unit: lump sum (Sum)**

Separate items are provided for the various aspects of the Contractor's general obligations, overheads, construction management, supervision, etc., as applicable to Sub- Parts and or Parts of the Works or specific operations of shorter duration respectively.

The FC sums shall be full compensation in respect of the Contractor's FC's not already included under item 1.001 for financing, recruitment / mobilisation, establishment, setting up of systems and facilities, etc., as applicable for the timeous and due fulfilment of the Contractor's respective early obligations to each Sub- Parts and or Parts of the Works.

In addition to the items listed under payment Clause 1.001, each relevant item will be certified for payment after the following:

- a) Overheads, Management and Supervision as applicable to Parts of the Works or specific operations of shorter duration: After 75% of the Contractor's supervision (foreman level and above) specific to each Sub- Parts and or Parts of the Works respectively have been fully mobilised on the Site, ready to commence work; and
- b) Continuing care of Sections or parts of the Works for which Taking-Over Certificates have been issued, in accordance with Sub-Clauses 10.1, 10.2 and 17.2 of the Conditions of Contract.

1.003 Provision and removal of facilities**Unit: lump sum (Sum)****or: number (No)****or: square (m²)**

Separate items are provided for general obligations for facilities and provision of engineering services, offices and accommodation, other services, name boards and signs, assistance and equipment as applicable.

The FC sums shall be full compensation in respect of the Contractor's charges not already included elsewhere for the timeous provision, erection, establishment, construction and Tests on Completion

PART C3.1 - SPECIFICATION

(as applicable) on the Site the specified facilities, services, etc., adequately equipped to allow work to commence and proceed to completion in due fulfilment of the Contract, including for:

- a) Initial financing, mobilisation and transport to the Site;
- b) Installation including any ancillary works such as earthworks, foundations, access provisions, structures, security and other fencing, gates, etc., not already covered in rates and prices provided elsewhere in the BoQ;
- c) Demolition or dismantling when the facility is no longer required as authorised by the Engineer;
- d) Provision of all necessary interior fixtures / fixed furniture, equipment, services, access, etc., as applicable to render the facility fit for the specified or implied purpose for which it is provided except where otherwise specified;
- e) Removal from the Site as applicable;
- f) Reinstatement and rehabilitation of the Site; and
- g) Particular provisions not already covered above in respect of each group of equipment to render it continuously fit for the specified or implied purpose for which it is provided:
 - i) Maintenance of facilities provided by the Employer as described in Clause 1.6;
 - ii) Facilities to be provided and maintained by the Contractor primarily for the use of the Engineer which includes the Engineer's Site offices in construction establishment areas on the Site as described in Clause 1.7; and
 - iii) Facilities to be provided and maintained by the Contractor to his construction establishment areas primarily for his own purposes, as described in Clause 1.8.

Fencing to the designated areas defined in Clause 1.4.1 a) will be measured elsewhere in the Bill of Quantities. Fencing to the designated areas defined in Clause 1.4.1 b) will be measured under this Clause.

1.004 Equipment Provision and removal of Unit: lump sum (Sum)
equipment

Separate items are provided in the categories of equipment for the Contract in general and equipment specific to Parts of the Works or certain operations respectively. Such equipment shall include Contractor's Equipment and Temporary Works.

The FC sums shall be full compensation in respect of the Contractor's FCs for the timeous provision, erection, establishment (including any re-establishment as required) and Tests on Completion (as applicable) on the Site, the groups of equipment such as to allow work to commence and proceed to completion in due fulfilment of the Contract, including for:

- a) Initial financing, mobilisation and transport to and within the Site;
- b) Installation including ancillary works such as earthworks, foundations, access provisions, structures, etc. not already covered in other rates and prices provided in the BoQ;
- c) Dismantling on completion of the work when the equipment is no longer required as authorised by the Engineer;
- d) Removal from the Site;
- e) Reinstatement and rehabilitation of the Site; and
- f) Particular requirements not already covered above in respect of each group of equipment to render it fit for the specified or implied purpose for which it is provided.

PART C3.1 - SPECIFICATION

1.004a) Specific equipment relocation **Unit: Number (No)**

Further to the provisions under item 1.004, this FC rate shall cover all additional related charges per event for the relocation (within 5 km) of equipment from a pipeline work front to a different work front when instructed by the Engineer (within 5 km). Including provision for the loss of production.

1.004b) Equipment for Jet Grouting **Unit: lump sum (Sum)**

This separate FC sum shall be full compensation in respect of the Contractor's FCs for the timeous provision, erection, establishment and Tests on Completion (as applicable) on the Site, the groups of equipment such as to allow work to commence and proceed to completion in due fulfilment of the Contract not covered under Item 1.004a).

1.004c) General fixed charges for de-establish and re-establish of Jet Grouting Equipment due to flooding **Unit: Number (No.)**

This separate FC sum shall be full compensation in respect of the Contractor's FCs for the timeous de-establishment and re-establishment as required to deal with flooding not covered under Item 1.004a).

1.004d) Equipment for Jacking and Grouting **Unit: lump sum (Sum)**

This separate FC sum shall be full compensation in respect of the Contractor's FCs for the timeous provision, erection, establishment and Tests on Completion (as applicable) on the Site, the groups of equipment such as to allow work to commence and proceed to completion in due fulfilment of the Contract not covered under Item 1.004a).

1.15.11 Time-Related Charges
1.005 Primary general obligations **Unit: lump sum (Sum)**

Separate items are provided as for item 1.001.

The TRC sums shall be full compensation in respect of the Contractor's TRC's not already included under item 1.001 for continuing the respective obligations under the Contract for the respective programme durations in weeks for each of the TRC items of the Preliminary and General part and sub-sections of parts of the Bill of Quantities. Such sums shall include for financing, depreciation, continued provision, replacements, operation, maintenance and running of systems and facilities, etc., as applicable, for the due fulfilment of the Contractor's respective on-going obligations, including for:

- a) Compliance in full with the Conditions of Contract as relevant to each item;
- b) Compliance in full with any details required in terms of the Specification, Section 1 as relevant to each item;

PART C3.1 - SPECIFICATION

The TRC sums shall be full compensation in respect of the Contractor's TRCs not already included under item 1.003 for the continued provision, operation and maintenance of the specified facilities for the respective programme durations in weeks as provided in the Bills of Quantities for each TRC item for the due fulfilment of the Contract, including for:

- a) Continued financing of the facilities such as rentals, salaries and wages directly associated with the facility, interest and depreciation charges on buildings, furnishings, equipment, services, access provisions, etc.;
- b) Timeous repairs, replacements, renewals and other maintenance necessary to keep the facility and associated furnishings etc., as a) above in a fit state of operation at all times for the specified or implied purpose for which it is provided on the Site;
- c) Operation as required including for all staffing, fuels, power consumption, consumables, etc.;
- d) Particular provisions as specified in the Specification, Section 1 in respect of the various categories of facility as listed under item 1.003 (g); and
- e) Maintenance and keeping in operation of all the respective FC items as listed under the bullets of Clause 1.001 above.

1.007a) Specific equipment relocation Unit: Number (No)

Further to the provisions under item 1.007, this TRC rate shall cover all additional related charges per event for the relocation (within 5 km) of equipment from a pipeline work front to a different work front when instructed by the Engineer (within 5 km). Including provision for the loss of production.

1.007b) General TRC's for Jet Grouting (Facilities) Unit: lump sum (Sum)
(Duration weeks)

This separate TRC sum shall be full compensation in respect of the Contractor's TRCs not already included under item 1.007 for the continued provision, operation and maintenance of the specified facilities for the respective programme durations in weeks as provided in the Bills of Quantities for each TRC item for the due fulfilment of the Contract.

1.007c) General TRC's for Jet grouting facilities Unit: day (Day)
during standing time due to flooding
(Facilities)

This separate TRC sum shall be full compensation in respect of the Contractor's TRCs for the provision and maintenance of facilities required for jet grouting between and including de-establishment and re-establishment as required to deal with flooding not covered under Item 1.007.

1.007d) General TRC's for Jacking and Grouting Unit: lump sum (Sum)
equipment
(Duration days)

This separate TRC sum shall be full compensation in respect of the Contractor's TRCs not already included under item 1.007 for the continued provision, operation and maintenance of the specified facilities for the respective programme durations in days as provided in the Bills of Quantities for each TRC item for the due fulfilment of the Contract.

1.008 Operation and maintenance of equipment Unit: lump sum (Sum)

Separate items are provided as for item 1.004.

The TRC sums shall be full compensation in respect of the Contractor's TRCs not already included under item 1.004 for the continued provision, operation and maintenance of the specified equipment for the respective programme durations as provided in weeks in the BoQ for each TRC item for the due fulfilment of the Contract, including for:

- a) Continued financing of the equipment such as rentals, salaries and wages directly associated with the equipment, interest and depreciation charges;
- b) Timeous repairs, replacements, renewals and other maintenance necessary to keep the facility and associated furnishings etc., as (a) above in a fit state of operation at all times for the specified or implied function for which it is provided on the Site;
- c) Operation as required including for all dedicated operators and staff, etc.; and
- d) Particular provisions not already covered above in respect of each group of equipment to render it continuously fit for the specified or implied purpose for which it is provided.

1.008a) Specific equipment relocation Unit: Number (No)

Further to the provisions under item 1.008, this TRC rate shall cover all additional related charges per event for the relocation (within 5 km) of equipment from a pipeline work front to a different work front when instructed by the Engineer (within 5 km). Including provision for the loss of production.

1.008b) General TRC's for Jet Grouting (Equipment) Unit: lump sum (Sum)
(Duration weeks)

This separate TRC sum shall be full compensation in respect of the Contractor's TRCs not already included under item 1.008 for the continued provision, operation and maintenance of the specified Equipment for the respective programme durations in weeks as provided in the Bills of Quantities for each TRC item for the due fulfilment of the Contract.

1.008c) General TRC's for Jet grouting equipment Unit: Day (Day)
during standing time due to flooding
(Equipment)

This separate TRC sum shall be full compensation in respect of the Contractor's TRCs for the provision and maintenance of Equipment required for jet grouting between and including de-establishment and re-establishment as required to deal with flooding not covered under Item 1.008.

1.008d) General TRC's for Jacking and Grouting Unit: lump sum (Sum)
(Equipment)
(Duration days)

This separate TRC sum shall be full compensation in respect of the Contractor's TRCs not already included under item 1.008 for the continued provision, operation and maintenance of the specified facilities for the respective programme durations in weeks as provided in the Bills of Quantities for each TRC item for the due fulfilment of the Contract.

1.15.12 Quantity Proportional Charges

Separate items are provided in the parts of the BoQ for those items of a quantity proportional nature which comprise the re-measurable items of the BoQ. The pricing of such items shall provide for all matters as covered in detail in the relevant Specification and shall include in general for the quantity proportional costs of materials, labour, supervision, Contractor's Equipment (such as fuels, oils, power consumption, consumables, ground-engaging tools, etc.) and Temporary Works.

1.15.13 Provisional Sums

1.009 Provisional sums Unit: Provisional Sum (PS)

Certain items as specified in this Section and elsewhere in the Contract will be instructed or approved by the Engineer to be measured and certified for payment under Provisional Sums in Part A of the Bill of Quantities.

Where measurement and valuation is to be made in terms of Clause 13.5(b) of the Conditions of Contract, provision is made against these items for a percentage allowance on the net cost of each item provided under a Provisional Sum. The percentage allowance shall be deemed to cover all charges, obligations, overheads and profit in accordance with Clause 1.15. Unless otherwise agreed by the Engineer, the Contractor shall obtain a minimum of 3 quotations for each of the Provisional Sum items.

1.15.14 Performance payments (Not applicable to this Contract)

1.15.15 River Diversion

1.012 Design of the River Diversion Unit: lump sum (Sum)

The sum amount shall include for all cost to plan, design and obtain approval for the Vlieëpoort River Diversion. Should Option 1 (Employers concept) be used Items 1.013 to 1.016 and all key elements shall be priced. Should Option 2 (Alternative) be used the BoQ shall indicate the key elements and shall be priced accordingly. Refer to Clause 1.10.12 in this regard.

1.013 Selected filling from excavation material compacted to 93% AASHTO density Unit: Cubic metre (m³)

The rate shall be inclusive of all cost associated with the infilling between sandbags to form a coffer dam as per drawing No. 2B-C3-002.

1.014 Sandbags for coffer dam Unit: Number (No)

The rate shall be inclusive of all cost for the supply, fill with excavated material and place of 2.2 m x 1.4 m x 0.4 m geotextile fabric sandbags (as per Fibertex nonwovens or similar approved) up to 12 m high as per drawing No. 2B-C3-002.

1.015 Moving of sandbags**Unit: Number (No)**

The rate shall be inclusive of all cost to move and place in new position 2.2 m x 1.4 m x 0.4 m geotextile fabric sandbags.

1.016 Remove and discard sandbags**Unit: Number (No)**

The rate shall be inclusive of all cost associated with the removal and discard of a sandbag at a suitable waste facility.

1.017 Design, supply and construct access platforms as of when required for the duration of the Contract**Unit: lump sum (Sum)**

The rate shall be inclusive of all costs associated with the design, supply and construction of the access platforms and the removal thereof and rehabilitation of the surrounding areas (and the surrounding areas that are affected by the access platform) on completion of the works.

For payment purposes, 80% will be paid when the access platform has been constructed complete and to the satisfaction of the engineer (Employer's Representative). The remainder 20% will be paid when the platform has been removed and rehabilitated to the engineer's (Employer's Representative) satisfaction.

1.018 Design, supply and install river crossing structures as of when required for the duration of the Contract**Unit: lump sum (Sum)**

The rate shall be inclusive of all costs associated with the design, supply and construction / installation of the river crossing and the removal thereof and rehabilitation of the surrounding areas (and the surrounding areas that are affect by the river crossing) on completion of the works.

For payment purposes, 80% will be paid when the river crossing has been constructed complete and to the satisfaction of the Engineer. The remainder 20% will be paid when the river crossing has been removed and rehabilitated to the Engineer's satisfaction.

**ANNEXURE 1/1
KEY METHOD STATEMENTS**

PART C3.1 - SPECIFICATION

MS Number	Tender Schedule H Reference	Key Method Statements (MS)
		Key Management Process MS
MMS 1	H03	Occupational Health and Safety
MMS2	H02	Environmental Protection
MMS 3	H01	Quality Assurance
MMS 4	H04	Employment
MMS 5	H05	Preferential Procurement
MMS 6	H06	Procurement Management
MMS 7	H07	Subcontractor, Supplier and Service Provider Management
MMS 8	H08	Pipe Supply Management
MMS 9	H09	Construction Planning and Scheduling
MMS 10	H10	Construction Management and Supervision
MMS 11		Contractors Design
MMS 12		Commissioning
MMS 13		Security
MMS 14		Communication
MMS 15		Equipment Management
MMS 16		Site Accommodation and Transport
MMS 17		Site Establishment
MMS 18		Public Relations
MMS 19		Access Control
MMS 20	H20	Enterprise Development
MMS 21	H21	Skills Development
MMS 22		Maintain Site Services
MMS 23		Management of blasting activity notifications
MMS 24		As Instructed by the Engineer
		Key Construction Process MS
CMS 1		Surveying and Setting Out
CMS 2		Construction Fencing
CMS 3		Clearing Site
CMS 4	H12	Dealing with Water
CMS 5		Construction Lighting
CMS 6		Fire Control
CMS 7		Haul Road Construction
CMS 8		Dust Suppression
CMS 9		Road Signage
CMS 10		Road Maintenance
CMS 11		Mobile Cranage
CMS 12		Stripping Top Soil

PART C3.1 - SPECIFICATION

MS Number	Tender Schedule H Reference	Key Method Statements (MS)
CMS 13		Managing Fertile Soil
CMS 14	H13	Pipe Trench Excavation
CMS 15	H22	River Diversion
CMS 16	H23	Drilling and Grouting (Jet grouting)
CMS 17	H13	Drilling and Blasting
CMS 18		Bulk Surface Excavation
CMS 19		Rock Support
CMS 20		Pipe Manufacturing and Factory Testing
CMS 21		Pipe Handling, Transportation and Storage
CMS 22	H14	Pipe Laying and Testing
CMS 23	H15	Details of Welding and Weld Testing
CMS 24	H15	Radiographic Testing
CMS 25	H16	Joint Repairs (Lining)
CMS 26	H16	Joint Repairs (Coating)
CMS 27	H17	Monitoring of Pipe Coating Integrity
CMS 28	H18	Mass Haul Management
CMS 29	H19	Spoil and Borrow Pit Management
CMS 30		Bedding
CMS 31		Backfilling
CMS 32		Cathodic Protection
CMS 33		Air - Valve Chamber Construction
CMS 34		Scour Valve Chamber Construction
CMS 35		Isolating Valve, Pigging Chamber Construction
CMS 36		Embankment Construction
CMS 37		Concrete Batching
CMS 38		Polluted Water Treatment
CMS 39		Reinforcement Steel Fixing
CMS 40		Concrete Shuttering
CMS 41		Scaffolding
CMS 42		Concrete Pouring
CMS 43		Concrete Pumping
CMS 44		Concrete Floor Construction
CMS 45		Concrete Curing
CMS 46		Concrete Finishing
CMS 47		Concrete Repairs
CMS 48		Built in Components
CMS 49		Erection of Steel Structures
CMS 50		Install Roofing Sheets
CMS 51		Brickwork Construction

PART C3.1 - SPECIFICATION

MS Number	Tender Schedule H Reference	Key Method Statements (MS)
CMS 52		Paving Construction
CMS 53		Gravel Road Construction
CMS 54		Gabion Erosion Protection Construction
CMS 55		Pump Manufacturing and Testing
CMS 56		Valve Manufacturing and Testing
CMS 57		Pipe Special Manufacturing and Testing
CMS 58		Overhead Crane Manufacturing and Testing
CMS 59		Installation of Mechanical Plant
CMS 60		Pump Motor Manufacturing and Testing
CMS 61		Soft Starter Manufacturing and Testing
CMS 62		Transformer Manufacturing and Testing
CMS 63		Switch Gear Manufacturing and Testing
CMS 64		Installation of Electric Cables
CMS 65		Installation of Electrical Plant
CMS 66		Control Systems for Manufacturing and Testing
CMS 67		Installation of Fibre Optic Cable
CMS 68		Installation of Control Systems System
CMS 69		Installation of Security System
CMS 70		Construction of Security Fencing
CMS 71		Construction of Security Fencing(Electric)
CMS 72		Landscaping
CMS 73		Reinstatement of vegetation (Rehabilitation)
CMS 74		Installation of Microwave Towers Masts
CMS 75		OTDR Testing of Fibre Optic Cables
CMS 76		Network Design Philosophy (Primary and Secondary Networks)
CMS 77		Construction of sub-surface drains for reservoirs and balancing dams
CMS 78		<p>Construction of an HDPE geomembrane and geocell lining system on a specified subgrade with geocells filled with sand cement grout (mortar), soilcrete, stabilised soil cement, concrete, sand or any combination of the aforementioned materials where the geocells are above the HDPE geomembrane. The HDPE geomembrane and geocell lining system will be separated from the geocell by a layer of sand or low PI soil on the floor of any reservoir and (quite likely) be placed directly on the subgrade on the inside side slopes of the reservoir. A geotextile layer, or layers, might be required on the underside of any HDPE geomembrane.</p> <p>Method statements (MS) are to include for joints in the lining system (HDPE geomembrane, geocells and geotextiles or any combination thereof), joints at the dividing walls of the different compartments of the Balancing Reservoir and Break Pressure Reservoir, joints at all concrete structures, joints at permanent vehicle ramps (if any), whether the ramps are reinforced concrete slabs or other, and joints where anchor trenches concrete structures e.g. the spillway.</p>
CMS 79		Electric Leak Location Survey (ELLS).

PART C3.1 - SPECIFICATION

MS Number	Tender Schedule H Reference	Key Method Statements (MS)
CMS 80		Construction of embankments for reservoirs and balancing dams including all excavations, foundation preparation, permanent vehicle ramps (if any, whether reinforced concrete slabs or other), all drainage systems e.g. chimney drains, blanket drains (if applicable) and finger drains etc.
CMS 81		Excavation, selection, processing (including crushing, screening, washing, blending [if blending is necessary]), placing, and compacting of all materials for embankments for reservoirs and balancing dams. Materials includes rockfill, transition zones, filter materials and drains e.g. blanket drains, finger drains, chimney drains and sand collars, and gravel or crushed stone for erosion protection of downstream face of the embankment.
CMS 82		Large scale gradings for rockfill, boulders, and cobbles (before and after placing in the embankment for a reservoir or balancing dam).
CMS 83		Large scale bulk density tests on rockfill, boulders and cobbles after placing in the embankment for a reservoir or balancing dam (water replacement tests in hand excavated and lined holes).
CMS 84		Watertightness of all compartments of the Balancing Reservoir and the Break Pressure Reservoir to full water depth above the lowest floor level of the reservoir, where full water depth is full supply level (FSL) of the Reservoir as shown on the drawings minus lowest floor level of the Reservoir. Watertightness of the lining system is to be tested in increments of 1.0 m depth of water.
CMS 85		Structural condition surveys.
CMS 86		Construction machines vibration monitoring.
CMS 87		For each stream crossing.
CMS 88		As instructed by the Engineer.

**ANNEXURE 1/2
SITE LABORATORY REQUIREMENTS**

PART C3.1 - SPECIFICATION

The Laboratory building shall conform to the building standards and building services standards as specified in Clauses 1.7 and 1.8. The various areas for the Engineer and Contractor within the Site Laboratory shall comprise but not be limited to the following:

Laboratory	- Concrete	30 m ²
	- Soils	50 m ²
2 Offices (1 each for Engineer and Contractor)		9 m ² each
Store (with security lock)		16 m ²
Cube curing area		16 m ²
Veranda with concrete floor (covered)		60 m ²
Toilets and wash room		12 m ²

The above floor areas are minimum requirements.

Shelf space provided against walls shall be of robust construction and shelving shall be in suitable timber or steel material as required. Shelving below work tables shall be 400 mm above floor level. Shelving above walking areas shall be 2 000 mm above floor level.

Work-bench areas shall be of two types:

- a) Wooden construction: The tops shall be hard and smooth, free from warping and other defects; and
- b) Concrete tops: The tops shall be at least 75 mm thick reinforced concrete slabs with a smooth, hard steel-trowel finish, set horizontally in both directions.

All work benches shall be free standing, of sturdy construction, and the upper surfaces shall be 920 mm above the floor level, with a minimum surface area of 3.0 m² in each case.

**ANNEXURE 1/3
LABORATORY EQUIPMENT**

PART C3.1 - SPECIFICATION

In terms of Clause 1.8.3.9 of Specification Section 1 - General, the Contractor shall supply the following minimum equipment for the Site Laboratory.

The Contractor shall note that he is also required to provide any additional equipment and apparatus not provided for in the following list that he considers necessary for the control of quality in terms of the Contract.

The Contractor shall submit a separate list indicating the testing and inspection of equipment, Plant or materials off-site including the name of the organisation responsible.

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity Conc / Soil	
	Aggregates							
1.01	Flakiness gauge	Aggregates	1.6 mm thick			Tmh1 B3	1	
1.02	Moisture meter	Measure Moisture content of aggregates quickly.					1	
1.03	Sand equivalent apparatus (Complete)	Asphalt / Seal Concrete					1	
	Concrete							
2.01	Carpenter square	Cube mould check	300 m			Tmh1 D1	1	
2.02	Concrete compressive testing machine	50/100/150mm concrete cube strength	Comp strength of conc 15 MPa a min		BS1610 BS1881	Tmh1 D1	1	
2.03	Concrete moulds	Cubes	150 mm x 150 mm x150 mm	+/- 0.15 mm		Tmh1 D1	60	
2.04	Concrete moulds	Cubes	100 mm x 100 mm x100 mm	+/- 0.15 mm		Tmh1 D1	12	
2.05	Concrete moulds	Cubes	50 mm x 50 mm x 50 mm	+/- 0.15 mm		Tmh1 D1	12	
2.06	Concrete Pan mixer	Mix design	50 lt				1	
2.07	Core drilling machine	Drilling	90 / 100 / 10 mm				1	
2.08	Cover meter Rebar locator	Measure Concrete cover thickness Locate reinforcement					1	
2.09	Hammer Rubber	Cubes				Tmh1 D1	4	
2.10	Metal cylindrical measure	Bulk density	15 l			Tmh1 B9	1	
2.11	Compaction rod	Slump Making of cubes	600 mm x 16 mm			Tmh1 D2	8	
2.12	Metal tamping rod		340 g				1	
2.13	Schmidt hammer	compressive strength "for a check"					1	
2.14	Slump Base plate	Slump	0.5 m x 0.5 m		SABS 862	Tmh1 D3	4	
2.15	Slump Mould	Slump	300 mm high B200 - T100 mm dia	+5-1.6 +3-1.6	SABS 862	Tmh1 D3	4	

PART C3.1 - SPECIFICATION

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity	
							Conc	Soil
2.16	Tamping bar (check spec)	Cubes	1.8 kg	+/- 0.1 kg			4	
2.17	Trays for carrying cubes	Cube				Tmh1 D3	60	
2.18	Vibrating table	Cubes / Beams				Tmh1 D1	1	
2.19	Vicat apparatus - complete	Setting time					1	
2.20	Water - Circulator	Curing bath					3	
2.21	Water - Heater	Curing bath					3	
	Cores							
3.01	Capper	Capping the ends					1	
3.02	Saw - masonry (Diamond)	Cores - Cut					1	
	Data							
4.01	Computer with printer						1	
	General							
5.01	Balance (Electronic)	Cubes	12 kg	+0.1 g		Tmh1 D1	1	1
5.02	Balance (Electronic)	Pi Stabilization, Titration	0-300 g	+0.01 g		Tmh1 A2,A3		1
5.03	Balance (Electronic)	Moisture contents	2 kg	+0.1 g		Tmh1	1	1
5.04	Balance (Electronic)	Seal, Asphalt MDD,CBR,UCS	8 kg	+0.1 g		Tmh1		1
5.05	Balance (Electronic)	Gradings	5 kg	+0.1 g		Tmh1		1
5.06	Burner gas + asbestos plates	Asphalt Soil - gradings Moisture contents					4	3
5.07	Calculator (Pocket)						2	2
5.08	Canvas sheet		2 m x 2 m				1	5
5.09	Canvas sheet	Asphalt / Seal	1 m x 1 m				1	
5.10	Carboy - Distilled water	Chemical and Soil	25 ℓ					1
5.11								
5.12	De-ioniser	Soil						1
5.13	Distiller (Water)	Soil						1
5.14	Drying oven (Additional racks)		240 ℓ				3	3
5.15	Drying oven (Additional racks)		40 ℓ					3
5.16	Drying oven (Additional racks)		400 ℓ				3	3
5.17	Drying oven (Thermostatical)		240 ℓ				1	1
5.18	Drying oven (Thermostatical)		400 ℓ				1	1
5.19	Drying oven (Thermostatical)		40 ℓ					1

PART C3.1 - SPECIFICATION

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity	
							Conc	Soil
5.20	Flow cone	Measure flow of grout					1	
5.21	Hammer- density	Sand replacement	2 kg			Tmh1 A10a		4
5.22	Hot plate electrical (Lab type)		300 mm x 300 mm				2	2
5.23	Jar or glass beaker	Soils – Mechanical analysis	500 ml			Tmh1 A5		15
5.24	Measuring cylinders (Glass)	Chemical and Soil	500 ml				1	1
5.25	Measuring cylinders (Plastic)	Soil	500 ml					2
5.26	Measuring cylinders (Plastic)	Soil	1000 ml					4
5.27	Mechanical sieve shaker	Gradings					1	
5.28	Mixing basins/baths Small	CBR	Small			Tmh1 A8		3
5.29	Mixing bowl (Steel)	PI - LL	100 mm dia			Tmh1 A2		10
5.30	Pans - round	Moisture contents Mechanical analysis	250 mm			Tmh1 A5,A7		20
5.31	Pans - square		350 x 250 mm			Tmh1 A1	10	20
5.32	Pans - square (S/Steel)	Gradings	300 mm					20
5.33	Rain gauge							1
5.34	Riffler 25mm openings							1
5.35	Riffler 37.5mm openings						1	1
5.36	Riffler Pans 25mm openings							3
5.37	Riffler Pans 37.5mm openings						3	3
5.38	Sample bags (Canvas/Nylon) Large		Large				20	50
5.39	Sample bags (Canvas/Nylon) Small		Small				20	50
5.40	Sample containers - large plastic drum	CBR - mixing	25 lt			Tmh1 A8		5
5.41	Sample containers - Polycrates large, SB60	MDD - mixing	Large			Tmh1 A7		20
5.42	Sample containers - Polycrates small, SB20	MDD - mixing	Small			Tmh1 A7		20
5.43	Sieve 0.075	Gradings	0.075 mm openings, 200 mm dia			Tmh1 A1A5B4	2	2

PART C3.1 - SPECIFICATION

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity	
							Conc	Soil
5.44	Sieve 0.150	Gradings	0.150 mm openings, 200 mm dia		SABS 197	Tmh1 B4	1	
5.45	Sieve 0.300	Gradings	0.300 mm openings, 200 mm dia		SABS 197	Tmh1 B4	1	
5.46	Sieve 0.425	Gradings	0.425 mm openings, 200 mm dia		SABS 197	Tmh1 A1A5B4	1	2
5.47	Sieve 0.600	Gradings	0.600 mm openings, 200 mm dia		SABS 197	Tmh1 B4	1	
5.48	Sieve 1.180	Gradings	1.180 mm openings, 200 mm dia		SABS 197	Tmh1 B4	1	
5.49	Sieve 13.20	Gradings	13.20 mm openings, 200 mm dia		SABS 197	Tmh1 A1A5B4	1	1
5.50	Sieve 19.0	Gradings	19.0 mm openings, 200 mm dia		SABS 197	Tmh1 A1A5B4	1	1
5.51	Sieve 19.0	Gradings	19.0 mm openings, 300 mm dia		SABS 197	Tmh1 A1		1
5.52	Sieve 19.0	Gradings	19.0 mm openings, 450 mm dia		SABS 197	Tmh1 A1	1	1
5.53	Sieve 2.000	Gradings	2.000 mm openings, 200 mm dia		SABS 197	Tmh A1		1
5.54	Sieve 2.360	Gradings	2.360 mm openings, 200 mm dia		SABS 197	Tmh1 B4	1	
5.55	Sieve 26.5	Gradings	26.5 mm openings, 200 mm dia		SABS 197	Tmh1 A1A5B4	1	1
5.56	Sieve 26.5	Gradings	26.5 mm openings, 300 mm dia		SABS 197	Tmh1 A1		1
5.57	Sieve 3.350	Gradings	3.350 mm openings, 200 mm dia		SABS 197	Tmh1 B4	1	
5.58	Sieve 37.5	Gradings	37.5 mm openings, 200 mm dia		SABS 197	Tmh1 A1A5B4	1	1
5.59	Sieve 37.5	Gradings	37.5 mm openings, 300 mm dia		SABS 197	Tmh1 A1		1
5.60	Sieve 37.5	Gradings	37.5 mm openings, 450 mm dia		SABS 197	Tmh1 A1		1
5.61	Sieve 4.75	Gradings	4.75 mm openings, 450 mm dia		SABS 197	Tmh1 A1		1
5.62	Sieve 4.750	Gradings	4.750 mm openings, 200 mm dia		SABS 197	Tmh1 A1A5B4	1	2

PART C3.1 - SPECIFICATION

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity	
							Conc	Soil
5.63	Sieve 53.0	Gradings	53.0 mm openings, 200 mm dia		SABS 197	Tmh1 A1A5B4	1	1
5.64	Sieve 53.0	Gradings	53.0 mm openings, 300 mm dia		SABS 197	Tmh1 A1		1
5.65	Sieve 6.700	Gradings	6.700 mm openings, 200 mm dia		SABS 197	Tmh1 B4	1	1
5.66	Sieve 63.0	Gradings	63.0 mm openings, 200 mm dia		SABS 197	Tmh1 A1A5B4		1
5.67	Sieve 63.0	Gradings	63.0 mm openings, 300 mm dia		SABS 197	Tmh1 A1		1
5.68	Sieve 75.0	Gradings	75.0 mm openings, 300 mm dia		SABS 197	Tmh1 A1A5B4		1
5.69	Sieve 9.500	Gradings	9.500 mm openings, 200 mm dia		SABS 197	Tmh1 B4	1	1
5.70	Sieve Lid	Gradings	Lid, 200 mm dia		SABS 197	Tmh1 A1A5B4	1	1
5.71	Sieve Pan	Gradings	Pan, 200 mm dia		SABS 197	Tmh1 A1A5B4	1	1
5.72	Spatula large		200 x 20 mm				4	
5.73	Spatula small	PI - LL	100 x 20 mm			Tmh1 A2		2
5.74	STD set weights							1
5.75	Stirring rod	Asphalt Soil	180 mm					5
5.76	Stop watch - electronic, digital						2	1
5.77	Straight edge	Mod / CBR / UCS Cubes Seal	300 mm				3	5
5.78	Thermometer - min / max	Temperature						1
5.79	Thermometer dial type - Tel tru						1	
5.80	Thermometer digital - electronic						1	
5.81	Thermometer glass			0-200 °C			2	2
5.82	Thermometer glass			0-50 °C			4	2
5.83	Thermometer surface	Asphalt / Seal Concrete surface					4	
5.84	Timer - Mechanical	Asphalt / Seal Soil						1
5.85	Vernier Caliper	Equipment check					1	1
5.86	Vernier Caliper	Linear shrinkage Measure core length						1
5.87	Wash bottle						4	2

PART C3.1 - SPECIFICATION

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity	
							Conc	Soil
5.88	Waterbath for RD (Thermostatical)						1	
	Other							
6.01	Air-tight containers	PI	45 ml			Tmh1 A2,A3		120
6.02	Air-tight containers	MDD	10 litre			Tmh1 A7		20
6.03	Air-tight containers	CBR	20 litre			Tmh1 A8		20
6.04	Basins		400 mm dia				10	20
6.05	Basins		500 mm dia				10	10
6.06	Billy cans Large	Density - Sand replacement	5 l			Tmh1 A10a		12
6.07	Billy cans Small	Density - Sand replacement	2 l			Tmh1 A10a		12
6.08	Brooms Hard						1	2
6.09	Brooms Soft						1	1
6.10	Brushes Brass or Copper						1	2
6.11	Brushes Nail (Hard or Bristle)						1	2
6.12	Brushes Paint		25-50 mm				1	1
6.13	Brushes Paint		50-100 mm				1	2
6.14	Chisels	Density Testing				Tmh A10		4
6.15	Enamel dish (Wax)							1
6.16	Flour scoop	Asphalt slump / cubes	310 mm				6	3
6.17	Gloves Asbestos						1	1
6.18	Gloves Rubber						2	
6.19	Padlocks	Security					1	4
6.20	Rake	MDD				Tmh1 A7		2
6.21	Refuse bin						1	1
6.22	Scoop (Flour)	MDD/CBR/USC	310 mm			Tmh1 A7A8A14		3
6.23	Shovel						2	3
6.24	Spade						4	4
6.25	Spanners	Steel moulds assembly	17"					2
6.26	Spoons - Table						3	4
6.27	Steel ruler		300 mm				4	3
6.28	Tape measure		30 m				4	4
6.29	Tape measure		3 m				4	4
6.30	Trowels - garden	Asphalt Cube making					4	
6.31	Trowels - plastering	Cube making				Tmh1 D1	4	
6.32	Water bucket	Asphalt	10 lt				4	
6.33	Wheel barrow						4	1
6.34	Wooden float	Cubes					4	

PART C3.1 - SPECIFICATION

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity	
							Conc	Soil
	Soil							
7.01	Base plate	MDD/CBR/UCS	25.4 mm high	+/- 1 mm		Tmh1 A7A8A14		3
7.02	Calibrating plate- Liquid limit device	Soil - Liquid limit				Tmh1 A2		1
7.03	CBR Hand operated	Soil - CBR	Max 55 kN 1.27 mm a min	+/- 50 N		Tmh1 A8		1
7.04	CBR Press	Soil - CBR	Max 55 kN 1.27 mm a min	+/- 50 N		Tmh1 A8		1
7.05	CBR Soaking bath - with temp. control	CBR	1 m x 2 m x 0.45 m			Tmh1 A8		3
7.06	CBR, UCS, ITS Press - Automatic	Soil - CBR,UCS,ITS	Look at b&c					1
7.07	Collar -Detachable for moulds	MDD/CBR/UCS				Tmh1 A7,A8,A1 4		3
7.08	Compaction hammer and sleeve	MDD/CBR/UCS	2.495 kg hammer 304.8 mm drop 50.8 mm face	+/-20 g +/-2 mm +/-1 mm		Tmh1 A8		2
7.09	Compaction hammer and sleeve	MDD/CBR/UCS	4.536 kg hammer 457.2 mm drop 50.8 mm face	+/-20 g +/-2 mm +/-1 mm		Tmh1 A7,A8,A1 4		3
7.10	Compactor (Mod AASHTO)	MDD/CBR/UCS	4.536 kg hammer 457.2 mm drop 50.8 mm face	+/-20 g +/-2 mm +/-1 mm		Tmh1 A7		1
7.11	Container (Sand)	Density - Sand replacement	200 l			Tmh1 A10a		1
7.12	Copper or brass gauze discs	CBR	170 mm diameter 0.3 mm mesh			Tmh1 A8		18
7.13	Crusher - Large	Soil clods, large aggregate crush						1
7.14	DCP (Dynamic cone penetrometer)	CBR Investigation				ASTM D6951		5
7.15	Density - sand replacement Cylindrical container-calibration	Density - Sand replacement	Dia and H=152 mm			Tmh1 A10a		1
7.16	Density - sand replacement Density funnel and wind shield	Density - Sand replacement				Tmh1 A10a		3
7.17	Density - sand replacement Density sand	Density - Sand replacement	40 kg			Tmh1 A10a		5
7.18	Density - sand replacement Dolly	Density - Sand replacement				Tmh1 A10a		3
7.19	Density - sand replacement Pegs	Density - Sand replacement				Tmh1 A10a		18
7.20	Density - sand replacement Pouring can	Density - Sand replacement				Tmh1 A10a		3

PART C3.1 - SPECIFICATION

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity	
							Conc	Soil
7.21	Density - sand replacement Ring	Density - Sand replacement				Tmh1 A10a		3
7.22	Dial guage divisions	CBR - swell	25 mm 0.01 mm devisions			Tmh1 A8		1
7.23	Dial guage divisions	CBR machine check	25 mm 0.127 mm devisions			Tmh1 A8		1
7.24	Distance meter (Tru-meter)	Seal Asphalt						1
7.25	Extruding jack	CBR Marshall				Tmh1 A7		1
7.26	Glass plate	Mould calibration Sand replacement	180 mm x 180 mm 7 mm thick					2
7.27	Grooving Tool (Liquid limit)	Soil - Liquid limit				Tmh1 A2		2
7.28	Ground-glass plate	PI - LL	150 mm x 220 mm			Tmh1 A2		1
7.29	ITS Breaking head	Stabilized soils				Tmh1 A16T		1
7.30	Liquid limit device	Soil - Liquid limit				Tmh1 A2		1
7.31	Metal piston	CBR	49.6 mm dia 4.536 kg	+/-0.5mm +/-50g				1
7.32	Mixing basins/baths Large	MDD	Large			Tmh1 A7	2	3
7.33	Mortar- Iron	Soil Grading	150 mm			Tmh1 A1		2
7.34	Moulds - MDD, CBR	MDD, CBR	152.4 dia x 152.4 mm high	+/-0.5mm +/-1mm		Tmh1 A7,A8		36
7.35	Moulds - Split comp: UCS/ITS	UCS/ITS	152.4 dia x 152.4 mm high	+/-0.5mm +/-1mm		Tmh1 A14,A16		3
7.36	Nuclear gauge Troxler Equipped: - Rod guide/Scraper plate - Drill pin - 4lb hammer - pin extraction tool - zippered case - Leak test kit - Data cable and software - Caution, radioactive sign - Padlock	Density - Compaction				Tmh1 A10		5
7.37	Perforated base plates - CBR	CBR/UCS	1.024 kg	+/- 10g		Tmh1 A8/A14		18
7.38	Pestle iron	Soil - Grading				Tmh1 A1		2
7.39	Pestle rubber tipped	Soil - Grading				Tmh1 A1		2
7.40	Pick (Complete)	Sampling						4
7.41	Prospecting pick	Investigation						1
7.42	Shrinkage trough	Soil - Shrinkage	150 mm x10 x 10 mm	+/- 0.25 mm		Tmh1 A4		50

PART C3.1 - SPECIFICATION

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity Conc / Soil	
7.43	Spacer Plates	MDD / CBR / UCS	25.4 mm	+/- 1 mm		Tmh1 A7,A8		3
7.44	Surcharge weight for penetration	CBR	5.56 kg	+/-50 g		Tmh1 A8		1
7.45	Surcharge weight with adjustable stem	CBR	5.56 kg	+/-50 g		Tmh1 A8		18
7.46	Tripod	CBR - swell				Tmh1 A8		1
7.47	UCS Press	Soil - UCS	Applying 140 kPa/s Max 200 kN	+ - 1N		Tmh1 A14		1
7.48	Water sprinkler							4
7.49	Wire scratch brush	Soil	26 gauge			Tmh1 A1,A5		1
7.50	All laboratory equipment listed in ASTM – D698 (latest)	Standard Proctor Densities	Latest ASTM – D698 (or latest equivalent as per SANS)			Latest ASTM – D 698 (or latest equivalent SANS)		3(s)
7.51	All laboratory equipment listed in ASTM – D1557 (latest)	Modified Proctor Densities	Latest ASTM – D1557 (or latest equivalent as per SANS)			Latest ASTM – D 1557 (or latest equivalent SANS)		3(s)

The term (s) in the far right hand column of Item 7.50 and Item 7.51, above, is an abbreviation for the word 'set'. Here the word 'set' means (or is deemed) to mean the 'set' of all items of laboratory equipment required (or all the items that are required) to carry out the Standard Proctor test method to determine the maximum dry density (MDD) of a soil at OMC in accordance with the method given in ASTM – D698 , as well as to carry out the Modified Proctor test to determine the maximum dry density (MDD) of a soil at OMC in accordance with the method given in ASTM – D1557, respectively, where and when required by the Engineer.

	<u>Soilcrete</u>							
8.01	Base plate	Measure flow of soilcrete					3	
8.02	Flow cone	Measure flow of soilcrete					3	
	<u>Embankment Construction</u>							
8.01	Fabricated rectangular screen (100 mm x 100 mm openings) with a frame on each side and two (2) handles (min.)	Gradings for rockfill, boulders, cobbles, crushed rock, gravel and similar material (before and after placing in an embankment)	Size such that it can be safely handled by two to 4 persons.			See note (1)	2	
8.02	Fabricated rectangular screen (125 mm x 125 mm openings) with a frame on each side and two (2) handles (min.)	Gradings for rockfill, boulders, cobbles, crushed rock, gravel and similar material (before and after placing in an embankment)	Size such that it can be safely handled by two to 4 persons.			See note (1)	2	

PART C3.1 - SPECIFICATION

Item	Type of equipment	Purpose	Size	Range	Spec	Method	Quantity Conc / Soil	
8.03	Fabricated rectangular screen (150 mm x 150 mm openings) with a frame on each side and two (2) handles (min.)	Gradings for rockfill, boulders, cobbles, crushed rock, gravel and similar material (before and after placing in an embankment)	Size such that it can be safely handled by two to 4 persons.			See note (1)	2	
8.04	Fabricated rectangular screen (200 mm x 200 mm openings) with a frame on each side and two (2) handles (min.)	Gradings for rockfill, boulders, cobbles, crushed rock, gravel and similar material (before and after placing in an embankment)	Size such that it can be safely handled by two to 4 persons.			See note (1)	2	
8.05	Fabricated rectangular screen (250 mm x 250 mm openings) with a frame on each side and two (2) handles (min.)	Gradings for rockfill, boulders, cobbles, crushed rock, gravel and similar material (before and after placing in an embankment)	Size such that it can be safely handled by two to 4 persons.			See note (1)	2	
8.06	Fabricated rectangular screen (300 mm x 300 mm openings) with a frame on each side and two (2) handles (min.)	Gradings for rockfill, boulders, cobbles, crushed rock, gravel and similar material (before and after placing in an embankment)	Size such that it can be safely handled by two to 4 persons.			See note (1)	2	
8.07	AN Other (1)	AN Other (1) equipment for gradings for rockfill, boulders, cobbles, crushed rock, gravel and similar material (before and after placing in an embankment)	Size (or sizes) such that can be safely handled by two to 4 persons.			See note (1)	Quantity as required	
8.08	Steel density ring (or flat wooden plate)	Large scale rockfill bulk density test (water replacement tests in hand excavated and lined holes)	1.0 m diameter (at least) and such that it can be safely handled by two to 4 persons.			See note (2)	2	

Notes:

- AN Other (1) type of equipment i.e. Item 8.07 for gradings for rockfill, boulders, cobbles, crushed rock, gravel and similar material (before and after placing of these materials in the embankment) is in addition to the screens listed above which have been fabricated from square rebar or heavy gauge wire screen.
AN Other (1) type of equipment includes tools, equipment, scales to accurately weigh portions of samples taken to 'make up' the total mass of any sample to approximately 2.00 tonne, at least.
- AN Other (2) type of equipment i.e. Item 8.08 for large scale field densities for rockfill, boulders, cobbles, crushed rock, gravel and similar material (after placing and compacting these materials in the embankment) is in addition to the steel density ring (or flat wooden plate).
AN Other (2) type of equipment includes tools, equipment, acceptable fixities to hold down the (or a) steel density ring, nail spikes driven through the four corners and sides of the wooden plate (or plywood sheet, if deemed appropriate for Site conditions) to secure the ring or plate to the fill surface material, 0.15 mm to 0.25 mm flexible synthetic liner to determine the volume of the ring above the uneven rockfill surface

PART C3.1 - SPECIFICATION

(rockfill surfaces are generally like a cobblestone surface following compaction) and buckets to be filled with water and weighed to fill the test hole.

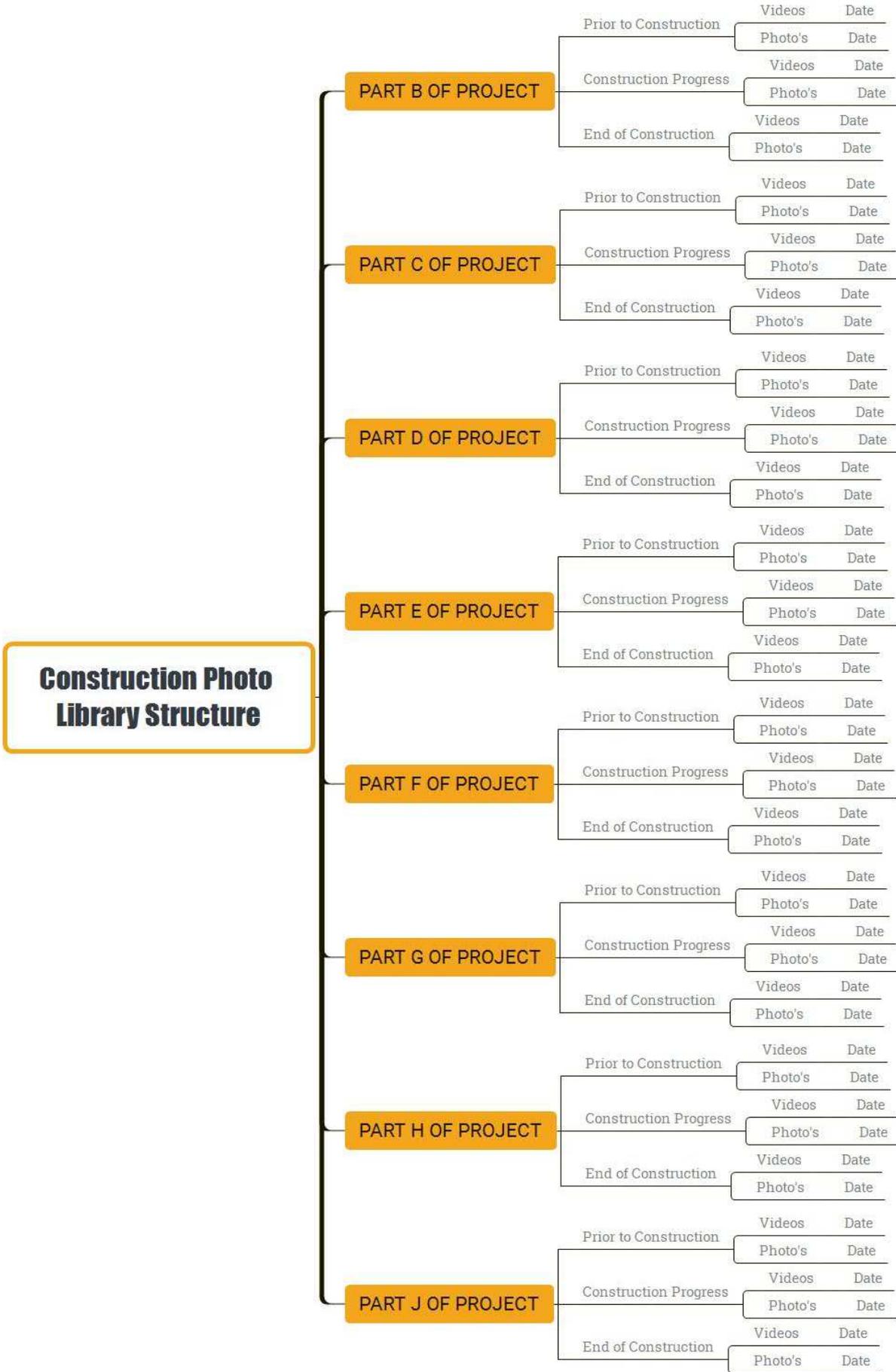
3. As a guideline to assist the Contractor with respect to the selection of site laboratory equipment (including that equipment for field tests) for large scale rockfill gradation and density and tests, he should refer to Infomine Rockfill, an E-Book titled 'Rockfill For Mines' by Allan Breitenbach (pp 1-31) which is readily available on the Internet.
4. The E-Book titled 'Rockfill For Mines' (and its references) should assist the Contractor with respect to the history of rockfill, basic principles of rockfill and modern practices related to rockfill.

Photo 18: 1 m diameter plate for large scale rockfill bulk density test, Photo 19: Water replacement test in hand excavated and lined hole, and Photo 20: Bulk gradation test on excavated rockfill materials in 'Rockfill For Mines' will assist the Contractor are particularly instructive in demonstrating the methods and equipment for large scale rockfill gradation and density and tests. These three photographs are guidelines for illustrative purposes and are not specifications.

5. The eleven (11) references on page 31 of 'Rockfill For Mines' should also provide the Contractor with useful guidelines with respect to the methods and equipment that could be used for large scale rockfill gradation and density and tests.

**ANNEXURE 1/4
PHOTOGRAPHIC LIBRARY STRUCTURE**

PART C3.1 - SPECIFICATION



**ANNEXURE 1/5
ENGINEER'S SURVEY EQUIPMENT**

PART C3.1 - SPECIFICATION

In terms of Clause 1.7.14 of Section 1 - General, the Contractor shall supply the following minimum survey equipment.

The Contractor shall note that he is also required to provide any additional equipment and apparatus not provided for in the following list that he considers necessary for the control of quality in terms of the Contract.

No.	Item Description	Quantity
1	GPS Handheld Set	6
2	RTK Trimble R4s GPS GNSS System (Rover)	3
3	Total Station	Shared with Contractor
4	Accessories	Shared with Contractor
5	Dumpy Level	8
6	Levelling Staff	8
7	Miscellaneous Tools	4

Notes:

1. GPS: Minimum configuration shall be a set of two units consisting of a base unit and roving unit. The GPS instrument set shall be capable of survey grade accuracy (sub centimetre) and have RTK (real time kinematic) capability.
2. Total Station: Leica TS09 2" Power type instrument capable of measuring angles to at least 2 seconds. Accessories to be included are:
 - Tribrachs, the part that goes on the tripod and holds the instrument;
 - Carriers;
 - Reflectors and target plates;
 - Tripods, wooden tripods should be used;
 - Additional batteries: and
 - Storage media.

The Contractor shall arrange for the instrument to be serviced annually at his cost.
3. Surveyor's level: The Leica 728 or equivalent.
4. The following tools shall be supplied:
 - Hammers of various sizes for nails and pegs;
 - Machetes and bush saws for light bush clearing;
 - Large fencing pliers;
 - Large shifting spanners;
 - Various tape measures, e.g. 5 m and 50 m length;
 - A laser distance measurer;
 - Large umbrella and stand;
 - Concrete cover meters (x2);
 - Electronic distance meter / laser (x4)
 - Cordless drill such as a HILTI;
 - Builder spirit level; and
 - Handheld electronic laser measurement device.

ANNEXURE 1/6
INTEGRATION OF PIPE CONSTRUCTION TRAIN OF ACTIVITIES

PART C3.1 - SPECIFICATION

PIPE CONSTRUCTION TRAIN OF ACTIVITIES

The following information is provided to assist the Contractor with the planning and management of the integration of a balanced train of activities associated with pipe construction.

The pre-reconstruction activities comprise of the pre-construction survey, the fencing of the construction servitude or construction area(s), environmental search and rescue activities as well as clearing and grubbing of vegetation / rocks within the construction servitude.

The actual "construction train" activities comprise of the stripping and storage of the topsoil, the removal and storage of the fertile soil, drilling and blasting of rock, trench excavation, preparation of the trench bottom and the placing of the pipe bed, pipe laying, (this will include the actual laying of the pipe as well as the welding of the pipes segments, the testing of the welds and weld repairs if required), pipeline field joint coating repair activities, field joint internal lining repairs, placing the bedding cradle and selected fill blanket within the trench around the pipe, placing of the main backfill over the selected fill blanket, and placing the fertile soil within the trench excavation area.

Table A indicates the permissible upper limits applicable to the pre-construction and pipe laying activities, unless otherwise approved by the Engineer.

TABLE A: MAXIMUM ALLOWABLE LENGTH (PER PIPE LAYING FRONT) PRIOR TO COMMENCING OF CONSECUTIVE ACTIVITIES

Activities		MAXIMUM LENGTH (m)
Pipeline pre-construction activities	Preconstruction survey, the fencing of the construction servitude or construction area(s), environmental search and rescue activities, and clearing and grubbing activities.	Maximum of 2 200 m, for 5 pipes laid and welded per day.
Pipe laying activities	Strip and placement of topsoil in windrows.	Maximum of 850 m from last pipe laid in trench to the point where the topsoil has been stripped.
	Strip and placement of fertile soil in windrows.	
	Drill and blast.	
	Trench excavation.	
	Pipe Bed.	
	Pipe laying (Note 1):	
	• 3 pipes laid and welded per day.	400 m
	• 4 pipes laid and welded per day.	550 m
	• 5 pipes laid and welded per day.	700 m
	Field joint coating repair section.	Not more than 150 m ahead of selected fill blanket may be left uncoated.
Internal lining repairs.	Not more than 750 m behind the last pipe laid and welded.	

PART C3.1 - SPECIFICATION

Activities		MAXIMUM LENGTH (m)
Trench backfilling	Bedding Cradle, Selected Fill Blanket, Main Backfill and placement of fertile soil.	Not to exceed a length of 500 m.
	Cleaning of servitude, placement of topsoil,	Not to exceed a length of 500 m.
	Fertiliser and seeding	As agreed with Engineer to promote optimal growth of vegetation
Ancillary Infrastructure	Valves and associated pipework.	Not more than 750 m behind the last pipe laid and welded.
	Valve chambers, including riprap structures, cathodic protection structures, etc.	Not more than 750 m behind the installation of the pipework at the applicable chamber.
Reinstatement of road surface		To be completed within 2 working days after backfilling of pipe trench.

Notes:

1. Pipe lengths vary between 18 m and 19.2 m.
2. In dealing with water as required in terms of Section 8 – Dealing with Water, the Contractor shall, subject only to such particular items as are scheduled for designated hazards, properly and adequately protect the Works from flooding and damage by storm water, inflow from springs, and groundwater seepage. The Contractor shall implement appropriate measures to prevent water from any source from entering the excavations and shall keep the pipe trench free from water while carrying out excavation, preparation of the trench bottom, placing the pipe bed and until the trench is backfilled to the level below the top soil.
3. No timber or other organic materials shall be left in the excavation during backfilling without the written agreement of the Engineer.
4. The Contractor may use his discretion as to whether to backfill around joints before a pipeline section is hydrostatically tested. The Contractor shall be responsible for the location and repair of any leaks on the pipeline under hydrostatic test and no extra payment shall be made for any re-excavation and subsequent reinstatement that may be necessary to locate and remedy leaks or install cathodic protection items. Should the Contractor elect to leave joint holes open until after the hydrostatic test, he shall provide at his own expense effective and approved barricades and fences around each excavation.
5. In built-up areas, barricades shall be clearly visible at night and equipped with red warning lights.

**ANNEXURE 1/7
PROJECT STRUCTURE DIAGRAM**

PART C3.1 - SPECIFICATION

PSD DRAWING TO BE INSERTED
