

PART C3: WORKS INFORMATION

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C3.1 EMPLOYER'S WORKS INFORMATION

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SECTION 1

1 Description of the *works*

1.1 Executive overview

The Environmental Authorizations (Records of Decision) was granted by the National Department of Environmental Affairs and Tourism for the expansion of the Iron Ore terminal at the Port of Saldanha citing the specific condition that a Stormwater Management Plan that complies to the Department of Water Affairs and Forestry's (DWAF) is required. Consequently, in 2014, Transnet National Ports Authority (TNPA) appointed an engineering service consultant, Hatch Goba (henceforth the Hatch Report) to perform a Stormwater Management Plan Pre-feasibility study of the for Port of Saldanha. The scope of the Pre-feasibility included Transnet Port Terminal leased areas and concluded that existing stormwater management infrastructure in certain areas of the Terminal are inadequate for 1:50 year flood conditions. The Pre-Feasibility report considered options for the management, treatment and discharge of stormwater within the various study areas to ensure environmental compliance.

Following the Pre-Feasibility study, Transnet Port Terminals appointed Transnet Group Capital (TGC) in 2016 to undertake a Feasibility Study design study to upgrade the stormwater infrastructure in the Port of Saldanha and to execute the recommendations of the SWMP as listed in the ROD. The Feasibility Study included an Environmental Basic Assessment Report (BAR), performed by Nsovo Environmental Consulting in 2017, in line with the requirements of the National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) and the Environmental Impact Assessment Regulations of December 2014 as amended in April 2017 (the Regulations) to ensure environmental legislative compliance and inform the design. See Environment Management Programme (EMPr) report for more information.

From 2016 to 2021, the Saldanha stormwater concepts and feasibility designs were developed in compliance to the project's environmental BAR, as well as specific Terminal operational and maintenance requirements:

- The approved stormwater design concept is that of zero discharge - no discharge of stormwater runoff into the sea more than once every 50 years.
- The exception to the design concept of zero discharge is the Multi-Purpose Terminal (MPT) which will conform to the design concept of controlled discharge – discharge of stormwater is only allowed after passing through an approved filtration system.

The MPT was classified as having a low iron ore pollution concentration and approval was granted by the Department of Environment, Forestry and Fisheries (DEFF) for the controlled discharge through the application of a Coastal Waters Discharge Permit. In addition, two additional environmental licenses; Waste Management License and Water Use License were applied for and obtained from the DEFF and Department of Water and Sanitation for the disposal and storage of stormwater in ponds respectively. The two (2) environmental licenses and one (1) permit took a total of 3 years and 6 months for approval.

In 2022 after restructuring within the business, the TGC designs were handed over to Transnet Port Terminal designers who were tasked to take the Feasibility Study designs to Execution Phase designs. During the Execution design phase, a Design Change Notice (DCN) was issued in July 2022 to address Terminal maintenance challenges and project interface challenges as seen in

Annexure F. Detailed designs were completed to a level that is appropriate for construction during the Execution Phase.

The battery limit areas in Transnet Port Terminal's design scope (TPT areas only) included the following:

- Tippler Area
- Rail Embankment
- Multi-purpose Terminal
- Stockyard
- Causeway
- Iron Ore Jetty – excluded from the project scope. Terminal to address outside this project

For each of the above-mentioned areas, the engineering scope included the preparation of detailed design drawings, design criteria reports, design reports, stormwater management and maintenance plan and works information. See locality plan (Figure 1) showing all areas of concern.



Figure 1: Locality plan

1.2 *Employer's objectives*

The current strategy is to grow the iron ore export capacity, the current bulk cargo export and marine repair business in the Port of Saldanha. For the port to sustain current business and to comply with Environmental Legislation, the port operator must ensure that all conditions as stipulated in the environmental approvals for previous port developments / expansions specific to his/her operations are adhered to. The upgrading of the storm water infrastructure within the port therefore is an integral part of the strategic plan for the port expansion and viability.

1.3 Interpretation and terminology

The following abbreviations are used in this Works Information:

Table 1

Abbreviation	Meaning given to the abbreviation
AIA	Authorised Inspection Authority
BBBEE	Broad Based Black Economic Empowerment
CEMP	Construction Environmental Management Plan
CD	Compact Disc
CDR	Contractor Documentation Register
CDS	Contractor Documentation Schedule
CSHEO	Contractor's Safety, Health and Environmental Officer
CM	Construction Manager
CWDP	Coastal Waters Discharge Permit
DP	Data Pack
DTI	Department of Trade and Industry
DWG	Drawings
EA	Environmental Authorisation
EO	Environmental Officer
EMP	Environmental Management Plan
HAZOP	Hazard and Operability Study
FEQ	Field Engineering Query
GA	General Arrangement Drawing
HSSP	Health and Safety Surveillance Plan
ID	Personal identification document
ipIP	Industrial Participation
IR	Industrial Relations
IPP	Industrial Participation Policy
IPS	Industrial Participation Secretariat
IRCC	Industrial Relations Co-ordination Committee
JSA	Job Safety Analysis
CIRP	Contractor's Industrial Relations Practitioner
Native	Original electronic file format of documentation
NEMA	National Environmental Management Act
PES	Project Environmental Specifications
NCR	Non-conformance report
PHA	Preliminary Hazard Assessment
PIRM	Project Industrial Relations Manager
PIRPMP	Project Industrial Relations Policy and Management Plan

PLA	Project Labour Agreements
PLP	Project Lifecycle Process
PSIRM	Project Site Industrial Relations Manager
PSPM	Project Safety Program Manager
YPCS	Yard Point Control System
VIS	Vehicle Identification System
PSSM	Project Site Safety Manager
ProgEM	Programme Environmental Manager
ProjEM	Project Environmental Manager
PQP	Project Quality Plan
QCP	Quality Control Plan
QA	Quality Assurance
SANS	South African National Standards
SASRIA	South African Special Risks Insurance Association
SCD	Subsoil Collector Drain
SES	Standard Environmental Specification
SHE	Safety, Health and Environment
SHEC	Safety, Health and Environment Co-ordinator
SIP	Site Induction Programme
SMP	Safety Management Plan
SSRC	Site Safety Review Committee
°C	Degree Celsius
A	Ampere
D	Diameter
ECC	Earth Continuity Conductor
ECSA	Engineering Council of South Africa
FAT	Factory Acceptance Test
Hz	Hertz
km	Kilo meter
kVA	Kilo-Volt Ampere
LV	Low Voltage
m	meter
MCB	Miniature Circuit Breaker
MCC	Motor Control Centre
mm	millimetre
mm ²	millimetre squared
ORS	Owners Requirement Specification
PVC	Polyvinyl Chloride
SCADA	Supervisory Control and Data Acquisition
SANS	South African National Standards
WML	Waste Management Licence
WUL	Water Use Licence

2 Engineering and the *Contractor's* design

2.1 *Employer's* design

The *Employer* supplies the following:

- Works Information
- Technical specifications (See section 4.1 for complete list of technical specifications)
- General Arrangement, Layout and Detail Drawings (See section 5)

The list of drawings for providing the *Works* are listed in section 5 of this Works Information. The *Employer* grants the *Contractor* a license to use the copyright in design data presented to the *Contractor* for the purpose of the *works* ONLY.

2.2 Procedure for submission and acceptance of *Contractor's* design

The *Contractor* shall adhere to the following procedures:

- Submit designs in both hard copy and electronic native format to the *Project Manager* for review and approval.
- *Contractor* may not proceed with these *works* until written approval is obtained from the *Project Manager*
- The *Contractor* undertakes design safety reviews with the *Project Manager*, Safety Manager and other relevant personnel as determined by the *Project Manager*.

2.3 Review and Acceptance of *Contractor* Documentation

The *Contractor* is to design the following parts of the *works*, for acceptance by the *Project Manager*:

- Designs required to perform dewatering for proper execution of *works*.
- Designs for shoring required during excavations as specified in section 3.1 below.
- Other drawings, specifications and reports for equipment that the contractor is responsible for
- Any design alterations that the *contractor* may formulate to ensure the correct execution of the *works* unless expressly stated to form part of the design responsibility of the *Employer* as stated under 2.1 *Employer's* design above and whether or not specifically stated to form part of the design responsibility of the *Contractor* under this paragraph 2.2, all residual design responsibility and overall responsibility for the total design solution for the *works* rests with the *Contractor*.

2.4 Other requirements of the *Contractor's* design

The *Contractor's* design complies with the relevant SANS standards and Transnet Port Terminals standard specification.

2.5 Use of *Contractor's* design

The *Contractor* grants the *Employer* a licence to use the copyright in all design data presented to the *Employer* in relation to the works for any purpose in connection with the construction, re-construction, refurbishment, repair, maintenance and extension of such licence being capable of transfer to any third party without the consent of the *Contractor*.

The *Contractor* vests in the *Employer* full title guarantee in the intellectual property and copyright in the design data created in relation to the *works* as follows:

- Any design alterations that the contractor may formulate to ensure the correct execution of the works.

2.6 Design of Equipment

The *Contractor* submits his design details for the following categories of his proposed principal Equipment to the *Project Manager* for his information only:

As per works described in this works information and supplied drawings to the true nature and extent of the works.

The following principal Equipment categories deployed for the *Contractor* to provide the Works require.

its design to be accepted by the *Project Manager* under ECC Clause 23.1:

- Equipment required to be included in the works.
- As per works described in this works information and supplied drawings to the true nature and extent of the works.
- As-built drawings, operating manuals and maintenance schedules.

2.7 Timetable for Submission of Documents

Refer to the *Contractor* Documentation Schedule (CDS) contained in Annexure 2 for the timetable of submission of as-built drawings, operating manuals and maintenance schedules. This timetable shall also be accurately reflected in the *Contractor's* Documentation Register (CDR). The *Contractor* submits the first issue of the CDR to the *Project Manager* within 7 days of the Award of Contract.

2.8 As Built/Final Documentation

This is defined as Certified 'As Built /Final Accepted' documentation for which no further review is required. The final documentation shall form part of the final *Contractor* Manual(s) or Data Packs.

The *Contractor* shall provide documents that will have an As-Built status are detailed within each Contract or Procurement package in the *Contractor* Documentation Schedule (CDS).

The *Contractor* shall provide the 'As-Built' documentation that forms part of the Operating, Instruction and Maintenance Manuals that were issued and accepted prior to 'As-Built' conditions for inclusion in these types of manuals by the *Project Manager*.

2.9 Maintenance and Operating Manuals and Data Packs

The *Contractor* compiles and delivers the Maintenance and Operating Manuals and Data Packs as prescribed in the Contractor Documentation Schedule (CDS).

These shall be supplied by the *Contractor* as manuals in a loose-leaf A4 hard covered, red, grease- and water-proof 4D-ring binder.

Drawings and charts larger than A4 shall be folded and those greater than A3 shall be enclosed in an A4 plastic pocket of adequate strength.

Manuals shall be well indexed and user friendly. Manuals shall include a summarized Table of Contents and in manuals comprising a number of files/volumes there should be one summarized Table of Contents in each of the files/volumes. The draft Table of Contents shall be submitted for review to the *Project Manager* prior to the compilation and official submittal of the manuals. The technical content of manuals shall be specified by the *Project Manager*.

The originals of all brochures shall be issued to the *Project Manager*. When a general brochure is applicable to a range of equipment, then a specific item, catalogue number or model number shall be stated, which is best achieved by introducing a separate index page, which cross-references the specific item to a tag number.

The address, phone numbers, fax numbers and reference numbers of all *Sub-Contractors* and Suppliers shall be provided.

Where manuals contain drawings that still need to be revised to "As-Built" status, and such manuals are required prior to "As-Built" status, the manual will not be considered to be in its final form until the "As-Built" version of each drawing has been incorporated.

A typical example of what the binder/file(s) shall be marked with on the spine and the front cover is as follows: -

- Project Name
- Manual Title, e.g. Installation, Maintenance and Operating Manual
- FBS No. and Title
- Manual Numbering (e.g. Volume 1 of 2, etc.)
- Contract Number
- *Contractor* Name

Four hard copies of each manual are to be supplied. One copy of each of the Maintenance and Operation Manuals are to have each page laminated in clear plastic. In addition to the hard copies, the *Contractor* is to provide two electronic copies of each manual in PDF format. Each copy of each manual is to be provided on a separate, clearly marked CD-ROM.

Where it is practical to do so, hard copies of the Maintenance and Operation Manuals may be combined.

Refer also to the Data Packs and Manuals section of the 'Contractor Document Submittal Requirements' DOC-STD-0001. Where there is any contradiction between the contents of DOC-STD-0001 and this section of the Works Information, the contents of this section shall apply.

Operating manuals and maintenance schedules shall be supplied for each component supplied under this contract, in particular and without limitation operating manuals and maintenance schedules will be required for:

- Operating manuals for the entire system including but not limited to:

- Start-up procedures
 - Alarms
 - Safety systems and equipment
 - Control systems and architecture.
- Maintenance manuals for structural steel and *Contractor's* specific equipment. The manuals shall be provided in four paper copies carefully bound into four volumes. In addition, two electronic copies in pdf format shall be provided, the electronic copies shall be provided on compact discs.

3 Construction

3.1 Temporary *works*, Site services & construction constraints

3.1.1 *Employer's* Site entry and security control, permits, and Site regulations.

The Site is located within an operational area of the *Employer* and the *Contractor* shall ensure the safe passage of traffic to and around the Site at all times. This shall entail the provision of flagmen, protective barriers, lanterns, signs, etc. for protection, direction and control of traffic.

The *Contractor* shall organize the work to cause the least possible inconvenience to other construction activities or operations at the Site. Access for Others to adjacent areas shall be maintained at all times.

The Site is located within a designated Secure Area, and accordingly all access into the area will be through a gate with access control.

The *Contractor* shall obtain the necessary entry permits for all staff working within the area in accordance with the access control requirements of the *Employer* and shall issue each personnel member with an appropriate identification card.

All costs incurred in providing construction personnel with ID cards and access permits shall be borne by the *Contractor*.

The site establishment area shall be clearly sign posted and be compliant with the relevant safety regulations and restrictions that might be in place until the *Contractor* has de-established from site and comply with OHS Act 85 of 1993.

The *Contractor* is responsible for the security of the *Works* until completion and hand-over and must make his own arrangements for security and the safekeeping of his property. The *Contractor's* watchmen are allowed on Site for this purpose.

If the working area is situated within a Customs controlled area, the *Contractor* and his people shall observe all Customs regulations.

The fullest collaboration between the *Contractor*, the *Employer's* Operations Manager and the *Project Manager* is essential in regard to the continued operations of the *Employer*.

Housing of the *Contractor's* people on site is not permitted.

All work on, over, under or adjacent to railway lines and near high voltage equipment shall comply with Transnet SOC Limited codes of conduct.

3.1.2 The *Contractor* complies with the following requirements of the *Employer*:

As per paragraph 3.1.1 above.

3.1.3 Restrictions to access on Site, roads, walkways and barricades as per paragraph 3.1.1 above.

People restrictions on Site; hours of work, conduct and records:

The working hours shall be in accordance with the requirements of the Department of Labour or with the agreement of the relevant trade unions. This information relating to working hours shall be supplied to the *Project Manager* prior to commencement of the proposed working hours.

Contractor's staff shall be confined to the working area and defined access routes and shall not be allowed to be present in other areas of the *Employer*. *Contractor* staff found disobeying this instruction will be subject to disciplinary action.

3.1.4 The *Contractor* keeps daily records of his people engaged on the Site and Working Areas (including Subcontractors) with access to such daily records available for inspection by the *Project Manager* at all reasonable times.

3.1.5 Health and safety facilities on Site

At all times during construction the *Contractor* is responsible for the safety of all persons on the Site and on the equipment and shall have the necessary systems and procedures in place to effectively manage this in relation to H & S requirements in addition to those of the OHSA Act and Regulation (85 of 1993, CR 2014).

3.1.6 The *Contractor* complies with the requirements stated under paragraph 2.3 of C3.1 *Employer's* Works Information.

3.1.7 Environmental controls, fauna & flora, dealing with objects of historical interest. The *Contractor* shall perform the *Works* and all construction activities within the Site and Working Areas having due regard for the environment and environmental management practices. As per project's Environmental Management Plan (EMP).

3.1.8 The *Contractor* complies with the CEMP and SES in the construction of the *works*, all as described in *Employer's* Works Information.

3.1.9 Title to Materials from demolition and excavation

3.1.10 Clause 73.2 states that the Contractor has title to Materials from excavation and demolition only as stated in the Works Information.

3.1.11 The *Contractor* has title to all Materials arising from excavation and demolition in the performance of the *works*. The *Project Manager* shall instruct the Contractor how to label, mark, set aside and/or dispose of such Materials for the benefit of the *Employer* in accordance with ECC Clause 73.1.

3.1.12 Cooperating with and obtaining acceptance of others.

During the course of the contract, departments of Transnet and other Contractors may be working in the general area surrounding the working area. The Contractor must make allowance for the necessity to interface with the activities of others, and to allow for safe access and working conditions.

3.1.13 Trenching and excavation work to obtain strict supervision of local signals department and in certain instance may require preparation work of the signal's Contractor. Reroute cables or boxes or decommission certain elements. Local signals to verify existing signal or VIS elements in vicinity. No new signal works required.

3.1.14 At least some of the Site work may take place while the adjacent areas will be in operation. The Contractor shall take all necessary steps for his Works not to interfere with operations and to ensure that normal traffic flow of the operational terminal is not obstructed.

3.1.15 The success of the project depends on the effective co-operation of all Contractors on site, and the Contractor, if necessary, must discuss his programme on a day-to-day basis with the Project Manager to ensure effective co-ordination.

3.1.16 Publicity and progress photographs

The *Contractor* treats all information gained through his appointment on this project as strictly confidential. The *Contractor* is not allowed to prepare or present any paper, publish any article in a technical journal, or derive publicity for his business which makes any reference to any aspect of the work on this project unless the *Employer* grants special permission, in writing, for the purpose.

No photographs are to be taken unless the photographer is in possession of a camera permit issued by the TNPA Chief Security Officer, Port of Saldanha. Photographs are to be taken for record purposes only.

The *Contractor* provides a comprehensive photographic record of the progress of the *Works* by taking photographs at weekly intervals. The initial photographs are to be taken at the start of the project, immediately prior to the commencement of any work. As far as possible each set of photographs shall be taken from the same locations as the previous set.

The areas to be photographed and the quantity of photographs in each area will be determined by the *Project Manager*.

Progress photographs of all manufacturing work carried out off-site are also required.

Photographs are to be submitted in JPEG format, with a minimum resolution of 1200 x 800. Each set of photographs must be accompanied by an index showing:

- Contract reference.
- Photograph file reference
- Date of Photograph
- Subject matter

3.1.17 The *Contractor* provides a notice.

3.1.18 The *Contractor* does not advertise the contract or the project to any third party, nor communicate directly with the media (in any jurisdiction) whatsoever without the express written notification and consent of the *Project Manager*.

3.1.19 *Contractor's Equipment*

All Equipment supplied and used by the *Contractor* on Site shall be selected and operated in such a way that design loadings of the particular areas are not exceeded and that damage to all existing surfaces and services are avoided. The *Contractor* will be required to repair, at his own cost and to the satisfaction of the *Project Manager*, any such damage caused by him.

The *Contractor* shall keep daily records of all Equipment used on Site and the Working Areas with access to such daily records available for inspection by the *Project Manager* at all reasonable times.

All Equipment necessary for the *Works* shall be provided and allowed for by the *Contractor*.

3.1.20 The *Contractor* keeps daily records of his Equipment used on Site and the Working Areas (distinguishing between owned and hired Equipment) with access to such daily records available for inspection by the *Project Manager* at all reasonable times.

3.1.21 Equipment provided by the *Employer*.

No Equipment will be provided by the *Employer*.

3.1.22 Site services and facilities:

When required in terms of the delivery methodology, a Site will be made available to the *Contractor* as erection Site and for all his Working Areas.

An electric supply point is available to the *Contractor* at this site, but the *Contractor* is responsible for connecting up and for cabling in the working area.

A potable water supply point is available to the *Contractor* at this site, but the *Contractor* is responsible for connecting up in the working area.

The *Contractor* shall make his own arrangements for the supply of other services such as ablutions, fire protection, lighting and all other services required for undertaking the *Works*. The *Contractor* shall provide, maintain and finally remove proper portable latrines of sufficient number at his cost. Latrines shall be properly constructed and placed in suitable positions and maintained in a clean and sanitary working condition.

Wherever the *Employer* provides facilities for the *Contractor's* use within the Working Areas and the *Contractor* adapts such facilities for use, then the *Contractor* makes good and provides full reinstatement to the land (including all apparatus of the *Employer* and Others in, on or under the land) and surrounding areas to its original standard upon dismantling of such facilities and hand-back to the *Employer*.

3.1.23 Facilities provided by the *Contractor*:

The *Contractor* submits the following drawings to the *Project Manager* for acceptance before commencing with the establishment of the site facilities:

Location drawing showing the area to be occupied by the *Contractor* in relation to the Port infrastructure.

Layout drawing of the proposed facilities.

The *Contractor* must ensure that the working area is well lit at night and that all the fences, obstacles and hazards are marked.

Project Manager's approval must be obtained for the use of any temporary lighting on the Site due to the impact that this may have on surrounding operations.

The *Contractor* must maintain the working area in a neat and tidy condition to the satisfaction of the *Project Manager*.

The *Contractor* must make his own arrangements for the disposal of sewerage and wastewater. Sewerage may not be disposed of on site. Transnet facilities may not be used.

The *Contractor* must make his own arrangements for telecommunication facilities, if required, for his use during the execution of the *Works*.

The *Contractor*, within fourteen days after completion, must completely remove from site all his plant, materials, Equipment, stores and temporary accommodation or any other asset belonging to him and leaves the site in a tidy condition to the satisfaction of the *Project Manager*. No excess or discarded materials, plant or stores may be buried or dumped within the *Employer's* boundaries.

Unless expressly stated as a responsibility of the *Employer*, Site services and facilities, all residual requirements for the provision of facilities and all items of Equipment necessary for the *Contractor* to Provide the *Works* remains the responsibility of the *Contractor*.

3.1.24 Wherever the *Contractor* provides facilities (either his own or for the *Project Manager* and/or *Supervisor*) and all items of Equipment, involving, *inter alia*, offices, accommodation, laboratories, Materials storage, compound areas etc., within the Working Areas, then the *Contractor* makes good and provides full reinstatement to the land (including all apparatus of the *Employer* and Others in, on or under the land) and surrounding areas to its original standard, upon dismantling of such facilities and items of Equipment.

3.1.25 Unless expressly stated as a responsibility of the *Employer*, Site services and facilities, all residual requirements for the provision of facilities and all items of Equipment necessary for the *Contractor* to Provide the *Works* remains the responsibility of the *Contractor*.

3.1.26 Existing premises, inspection of adjoining properties and checking work of Others.

The *Contractor* will be held responsible for any damage to existing structures and services caused by him during the execution of this Contract, fair wear and tear excluded, and shall repair damage to the satisfaction of the *Project Manager* before completion of the *Works*.

For this purpose, a joint inspection with the *Project Manager* and the *Contractor* will be carried out prior to occupation of the *Works* and any existing damage noted. Repair work to damaged existing structures and services may be carried out during the contract period or during the defect correction period if so authorized. The *Contractor* will be required to conduct a photographic site survey of the occupied area showing existing structures and services. This report must be submitted to the *Project Manager* for approval and will be used in assessing the damages to structures and services if applicable. Special site inspection is required to ascertain cables and location of (YPCS) Yard Port Control system and weighbridge cables in area.

3.1.27 The *Contractor* the work of with which the *works* interfaces in conjunction with the *Project Manager*.

3.1.28 Survey control and setting out of the *works*.

Immediately after the starting date, and prior to final design, the *Contractor* shall survey the complete site of final operation of the equipment or, if the site of final operation is not completed yet, obtain the necessary site arrangement and interface drawings from the *Project Manager*. This survey serves to confirm dimensions and relative positions of all things, existing or to be supplied by others that will interface with the equipment, for example location of electrical power supply points.

It is the *Contractor's* responsibility to ensure that the equipment supplied in terms of the contract interfaces successfully with all existing infrastructure.

Any deviation from the data supplied by the Employer in the Works Information must be brought under the attention of the Project Manager and discussed and finalized with the *Project Manager* prior to final design of the equipment.

3.1.29 Excavations and associated water control

All excavations deeper than 1.0m below ground level or as otherwise indicated by the Employer's Safety Officer and *Supervisor* in terms of the current Construction Regulations, shall either be fully shored, or the sides shall be battered back to a safe angle as determined by the strength of the soil and approved by the *Supervisor*.

Shallow ground water may be encountered in the excavations. Where this occurs, the *Contractor* is to provide suitable de-watering equipment. The discharge from the dewatering

equipment must be controlled in accordance with the requirements of the Standard Environmental Specification and Construction Environmental Management Plan. Discharge shall be into the nearest retention pond or storm water drainage system that drains into a retention pond. No discharge into the sea is not permitted.

3.1.30 Underground services, other existing services, cable and pipe trenches and covers.

The *Contractor* must, in collaboration with the *Supervisor*, ascertain whether or not the service is live. The *Contractor* shall not uplift any such service unless he is instructed to do so.

The *Contractor* shall be held responsible for any damage to existing services, and he shall take all necessary measures to protect them. All excavations to be preceded by proven services. In the event of a service being damaged, the *Contractor* shall immediately notify the *Supervisor*. The *Contractor* shall not repair any such service unless he is instructed to do so.

3.1.31 Where the *Contractor* encounters existing underground services / existing services cables / pipe, the *Contractor* should notify the *Project Manager*.

3.1.32 Control of noise, dust, water and waste

All Site activities must comply with the relevant parts of legislation.

3.1.33 The *Contractor* notifies the *Supervisor* of the elements of the *works* which are to be covered up.

3.2 Completion, testing, commissioning and correction of Defects

3.2.1 The *work* to be done by the Completion Date

On or before the Completion Date the *Contractor* shall have done everything required to Provide the *Works* including the work listed below which is to be done before the Completion Date and in any case before the dates stated. The *Project Manager* cannot certify Completion until all the work listed below has been done and is also free of Defects, which would have, in his opinion, prevented the *Employer* from using the works and others from doing their work.

3.2.2 Testing and commissioning of *Works*

Ater completion of the *Works*, the new *Works* shall be thoroughly tested to ensure all systems functions and performs to the desired specifications as per the Technical Specifications and design drawings and that all the works is free from any defects or issues that will prevent the *Employer* from using the *works*.

3.2.3 Use of the *works* before Completion has been certified.

In terms of Clause 35.2 in ECC the *Employer* may use any part of the works before Completion has been certified.

3.2.4 The *Contractor* ensures that the *Project Manager* has a full and accurate dossier of As-built documents that represent the status of the completed works (to include Plant within the works) to present to the Employer.

3.2.5 Access given by the *Employer* for correction of Defects.

Clause 43.4 requires that the *Project Manager* arrange for the *Employer* to allow the *Contractor* access to and use of a part of the works, which has been taken over if needed to

correct a Defect. After the works have been put into operation, the Employer may require the Contractor to undertake certain procedures before such access can be granted.

- 3.2.6 The *Contractor* complies with the following constraints and procedures of the *Employer* where the *Project Manager* arranges access for the *Contractor* after Completion:

Where the *Contractor* has to return to Site after Completion to rectify notified Defects, the Employer may either impose the same Site access / egress restrictions as communicated elsewhere under C3.1 *Employer's Works Information* at the starting date / access date stated under Contract Data - Part One, or as the works are now in use or the *Employer's* occupation of the Site may be incrementally or substantially changed post Completion, there may be further access / egress restrictions stated here at paragraph 3.2.13 of C3.1 *Employer's Works Information*.

4 Plant and Materials Standards and Workmanship

4.1 Standards and Specifications

All work done, and materials supplied, must conform to the requirements of the relevant standards as set out in the following schedules:

4.1.1 National and International Codes and Standards

Table 2

SANS Specifications	
SANS 1200	Code of practice for use with standardized specification for civil engineering construction
SANS 1200 A	General
SANS 1200 C	Site Clearance
SANS 1200 D	Earthworks
SANS 1200 DA	Earthworks (Small Works)
SANS 1200 DB	Earthworks (Pipes trenches)
SANS 1200 DM	Earthworks (roads, sub grade)
SANS 1200 G	Concrete (Structural)
SANS 1200 GE	Precast Concrete
SANS 1200 GM	Concrete (small works)
SANS 1200 L	Medium Pressure Pipelines
SANS 1200 LB	Bedding Pipes
SANS 1200 LC	Cable Ducts
SANS 1200 LG	Pipe Jacking
SANS 1200 LD	Sewers
SANS 1200 LE	Stormwater
SANS 1200 M	Roads General
SANS 1200 ME	Subbase
SANS 1200 MF	Base
SANS 1200 MH	Asphalt surfacing
SANS 1200 MJ	Segmented paving
SANS 1200 MK	Kerbing
SANS 1200 MM	Ancillary roadworks
SANS 927	Precast concrete kerbs, edgings and channels
SANS 731	Road markings Part 1: Single-pack solvent-borne paints
SANS 1091	National colour standard
HE 9/2/8	Corrosion protection
SANS 1083	Aggregates For Concrete
SANS 667	Pre-cast Concrete Pipes
SANS 10144	Detailing of Steel Reinforcement for Concrete
SANS 3000	Railway Safety Management. Requirements for systemic engineering and operational safety standards - Track and associated civil infrastructure and installations
SANS 3001	Civil Engineering Test Methods (various - replacing TMH1 of 1998)
SANS 10142	Code of Practice for the Wiring of Premises
SANS 10100-2:1992	The Structural use of concrete – Part 2: Materials and execution of work
SANS 50197-1	Cement – composition, specifications and conformity criteria. Part 1: Common cements
SANS 1491-1	Portland cement extenders – Part 1 Ground granulated blast furnace slag
SANS 1491-2	Portland cement extenders – Part 2 Fly ash.
SANS 1491-3	Portland cement extenders – Part 3 Condensed Silica Fume

SANS 110	Sealing compounds for the building industry, two-component, polysulphide base
SANS 1023	Preformed Elastomeric Compression Joint Seals

4.1.2 Transnet Standards and General Specifications

Table 2

Transnet Standards and General Specifications	
S406	Specification for the supply of stone
S410	Transnet Specification for Railway earthworks
E10	Specification for Railway Trackwork
E7/1	Works on, over, under or adjacent to railway lines & near high voltage equipment
E10/1 to E10/4	Supplementary specifications
SARTSM	Signing for railway crossings (Volume 2)
MTM 2012	Manual for track maintenance 2012
HE 9/2/8	Corrosion protection
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
BS 8110 Part 1	Structural use of Concrete
AASHTO M153	Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
Version 1.2.2.20	Stormwater Filtration System Specification
	Heavy Metals Filtration System Guidelines and Experiences

Where there is any contradiction between the requirements of the Transnet standard specifications and the requirements of this Works Information, the higher level of specification shall apply.

4.1.3 Environmental Standards

The stormwater design is governed by three environmental licenses:

- Coastal Waters Discharge Permit (CWDP)
- Water Use License (WUL)
- Waste Management License (WML)

The following standards and legislation apply to this project:

- The Constitution of South Africa (1996)
- National Environmental Management Act (1998)

(1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorized by law or cannot reasonably be avoided or stopped, to minimize and rectify such pollution or degradation of the environment.

(3) The measures required in terms of subsection (1) may include measures to—

(a) investigate, assess and evaluate the impact on the environment.

(c) cease, modify or control any act, activity or process causing the pollution or degradation.

(d) contain or prevent the movement of pollutants or the cause of degradation.

- Environmental Impact Assessment Regulations (2010)
- Saldanha Bay Municipality Storm Water Management By-Laws (2012)
- National Heritage Resources Act (1999)
- Integrated Coastal Management Act (2008)
- National Water Act No 36 of 1998

4.1.4 **Use of SANS 1200 Series of Specifications**

The SANS 1200 Series of Specifications are applicable to all Civil Engineering and Structural Works associated with this Contract.

In case of any conflict in interpretation, ambiguity or discrepancy between any SANS 1200 Specification (whether standard or written as a particular project specification) contained in the

Works Information and the conditions of contract, the conditions of contract take precedence. within the ECC3 contract.

In case of any conflict in interpretation, ambiguity or discrepancy between any SANS 1200 Specification (whether standard or written as a particular project specification) contained in this paragraph 4.3 and 4.4 of the *Employer's Works Information* and specific statements contained elsewhere in C3.1 *Employer's Works Information*, the specific statements contained elsewhere.

shall prevail, without prejudice to the *Project Manager's* express duty to resolve any ambiguity or inconsistency in the Works Information under ECC3 Clause 17.1.

4.1.5 **Interpretation of SANS terms**

Where SANS 10142 and/or SANS 10198 specifications are used within the Works Information,

then where the term "Equipment" (or the like) is used with the meaning of installation and items

left behind in the *works*, then please read this term as "Plant" for ECC3 defined term compliance.

Within SANS 1200 A: GENERAL, the following amendments and interpretations shall apply:

- Where the word or expression “Employer” is used, read “*Employer*”.
- Where the word or expression “Contractor” is used, read “*Contractor*”.
- Where the word or expression “Engineer” is used, read “*Project Manager*” or “*Supervisor*” as the context requires.
- Where the word or expression “schedule of quantities” is used, this is deleted in entirety.
- Assessment and payment are in accordance with the conditions of contract (and the ECC3 main and secondary options stated therein).

Within SANS 1200 A: GENERAL 2.3 DEFINITIONS, the following apply:

- “Acceptable. Approved (Approval)” is interpreted as either a *Project Manager* or a *Supervisor* communication or instruction in relation to Works Information compliance, consistent with the conditions of contract as the context requires.
- “Adequate” is deleted. The *Project Manager* notifies the *Contractor* where the *Contractor* has not complied with the Works Information.
- Assessment and payment are in accordance with the conditions of contract (and the ECC3 main and secondary options stated therein).

Within SANS 1200 A: GENERAL 2.6 APPROVAL, the following applies:

- “Approval” by either the *Project Manager* and/or the *Supervisor* is without prejudice to ECC3 Clause 14.1 and, inter alia, ECC3 Clauses 13.1, 14.3 and 27.1.

SANS 1200 A: GENERAL 2.8 ITEMS IN SCHEDULE OF QUANTITIES, is deleted in entirety. Assessment and payment are in accordance with the conditions of contract (and the ECC3 main and secondary options stated therein).

SANS 1200 A: GENERAL 3.2 STRUCTURES AND NATURAL MATERIAL ON SITE, applies only to the extent that it is consistent with paragraph 3.1.10 of C3.1 Employer’s Works Information.

Within SANS 1200 A: GENERAL 7.1 PLANT, the following applies:

- Where the word or expression “Plant” is used, read “Equipment”.

SANS 1200 A: GENERAL 7.2 CONTRACTOR’S OFFICES, STORES AND SERVICES, applies but the Project Manager resolves any inconsistency with statements included within paragraph 3.1.11 of C3.1 *Employer’s Works Information*.

SANS 1200 A: GENERAL 3.1 SURVEY, applies only to the extent that it is consistent with paragraph 3.1.13 of C3.1 *Employer’s Works Information*.

Within SANS 1200 A: GENERAL 3.2 WATCHING, BARRICADING, LIGHTING AND TRAFFIC

CROSSINGS, the following applies:

- Where the word or expression “specification” is used, read “Works Information”.

SANS 1200 A: GENERAL 3.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES applies only to the extent that it is consistent with the specific statements made elsewhere in C3.1 *Employer’s Works Information* and in any case and at all times consistent with the *conditions of contract*.

Within SANS 1200 A: GENERAL 5 TESTING, the following applies:

- Where the word or expression “Engineer” is used, read “Supervisor”.

SANS 1200 A: GENERAL 8 MEASUREMENT AND PAYMENT, is deleted in entirety. Assessment and payment are in accordance with the conditions of contract (and the ECC3 main and secondary options stated therein).

4.2 Quality Management (Assurance Requirements)

- The *Contractor* shall execute the works in accordance with the project specification “General Quality Requirements for Contractors and Suppliers” - QAL-STD-0001 Rev0 included in Annexure A of the Works Information.
- The *Contractor* shall submit his Quality Assurance (QA) proposal(s) for the contract. This proposal shall detail the *Contractor’s* quality management system as it applies to all aspects of supply or service provision including Design, Procurement, Manufacturing, Installation/Erection and Commissioning. Additionally, the *Contractor* shall include for the provision of suitably qualified quality control staff to manage and carry out inspection on all Supplier/Subcontractor activities in all disciplines included within the Works Information.
- The Quality Policy is a concise document, approved by the *Contractor’s* executive management that defines organizational goals and objectives regarding quality, a commitment to meeting stated requirements and an undertaking to drive continuous improvement throughout the organization’s activities. It must be suitable for the organization and provide a framework for stabilizing, communicating, and monitoring performance against agreed quality objectives.
- The *Contractor* shall submit a Project Quality Plan (PQP), which shall also contain specific proposals and details regarding Quality Control for the works. The PQP includes *Contractor’s* statement that outlines strategy, methodology, resources allocation and details about quality control for the works.
- The PQP is generally in narrative form detailing the Project Specific QA and QC systems and controls required by the *Contractor* for the specific works. Where the *Contractor* intends to employ any third-party organizations to execute quality related activities on his behalf, such intentions shall be stipulated in the PQP.
- The *Contractor* shall provide a full-time resident quality manager for all aspects of the works including Site activities, with a staff adequate to perform the requirements of his quality plan and quality management system.

- The nominated individual shall be fully conversant with quality management on major construction projects and the maintenance of an appropriate ISO 9001 Quality Management System.
- The *Contractor* shall submit the CV of his quality manager for the *Project Manager's* review and approval with a complete proposed organogram clearly indicating reporting levels and the number of resources dedicated to quality assurance and quality control.
- The *Contractor* shall have, maintain, and demonstrate its use to the *Project Manager* and/or the *Supervisor* to satisfy the requirements of paragraphs 4.4, 4.5, 5.2.1 and 5.2.8, as appropriate, of the documented Quality Management System to be used in the performance of the works. The *Contractor's* Quality Management System shall conform to International Standard ISO 9001 (or an equivalent standard acceptable to the *Project Manager*).
- The *Contractor* submits his Quality Management System documents to the *Project Manager* as part of his programme under ECC3 Clause 31.2 to include details of:
 - Project Quality Plan for the contract.
 - Quality Policy.
 - Index of Procedures to be used; and
 - a schedule of internal and external audits during the contract
- The *Contractor* develops and maintains a comprehensive register of documents that will be generated throughout the contract including all quality related documents as part of its Quality Plan.
- The *Project Manager* indicates those documents required to be submitted either for information, review or acceptance and the *Contractor* indicates such requirements within his register of documents. The register shall indicate the dates of issue of the documents with the *Project Manager* responding to documents submitted by the *Contractor* for review or acceptance within the period for reply prior to such documents being used by the *Contractor*.
- The requirements for a PQP are detailed in the project standard QAL-STD-0001 Rev0 and shall include but not be limited to the following:
 - Include all quality activities relevant to the works, identifying all procedures, reviews, audits, controls, and records used to control and verify compliance with the specified contractual requirements.
 - Include a listing of all special processes (e.g., welding, and non-destructive testing, cube testing etc.) envisaged for use, including confirmation of personnel certification as required.
 - Include a list of all proposed method statements (for Site based work activities)
 - Include a description of the Supplier/Contractor's project organization, with key positions and responsibilities identified and individuals named. The organization structure shall also indicate the resources committed to the management / coordination of QA / QC activities both within the main *Contractor's* organization and that of his Sub-Contractors and Suppliers
 - Include a listing of all pre- approved Quality Control Plans (QCP's), Quality Inspection Test Plans (QITPs) and associated Field Inspection Checklists (FIC's), as applicable.
 - Identify in the Project Quality Plan any Sub-Supplier/Sub-Contractor work. Sub-Supplier/Sub-Contractor plans shall be approved by the Supplier/Contractor, and a copy forwarded to the *Project Manager*
 - Include the proposed Authorized Inspection Authority (where applicable - for pressurized equipment and systems)
 - Include a schedule of proposed quality records (Data Book Index) which will form the permanent record of conformance to requirements.

- The index of procedures shall contain a list of the *Contractor's* quality management system procedures to be applied during the project including any relevant work instructions or 3rd tier quality system documentation. Where aspects of the works are to be subcontracted, the *Contractor* shall include procedures for the management of Suppliers and Sub-Contractors.

A schedule of internal and external audits during the contract means a schedule provided by the *Contractor* detailing the location, frequency, and extent of internal and external quality system audits to be carried out on during the contract period. The schedule shall include all locations including construction Site and supplier/service providers.

4.3 Investigation, Survey and Site Clearance

- 4.3.1 The *Contractor* shall obtain as built information of the site from Transnet (TPT and TNPA) prior to any construction. It is also the responsibility of the *Contractor* to verify all existing services and notify the *Supervisor* if any existing unforeseen services are encountered.
- 4.3.2 The *Contractor* is required to prove and protect existing services prior to construction for the full extent of the site. Please note any new services encountered during investigative *work* is to be brought to the attention of the *Supervisor* on site and marked up on the relevant drawing for as-built purposes. Any alternative provided by the *Contractor* to the *Employer's* design which significantly affects the services in the area must be taken into account by the *Contractor* and a method statement provided for the temporary and permanent protection subject to approval by the *Project Manager*. Please note that any alternate designs would require a guarantee of the proposed design for the full intended design life.
- 4.3.3 The *Contractor* shall take special note of any oil pipes that are encountered in the area of the scope of work, these pipes shall not be damaged in any way while completing the new works and be brought to the attention of the *Supervisor* on site. The *Contractor* shall ensure that any new services crossing existing pipelines shall be done according to the required standards with the dedicated cover between the two services.
- 4.3.4 The *Contractor* shall carry out his own pre- and post-construction survey of the site and obtain the *Supervisor's* agreement to the accuracy of data obtained.
- 4.3.5 The *Contractor* shall be responsible for ensuring that *works* are carried out to the setting out as shown on contract drawings and shall afford the *Supervisor* all facilities for checking as and when required. Such checking, however, shall not relieve the *Contractor* of his responsibilities for the accuracy of his setting out.

4.4 Civil Engineering

4.4.1 Civil Scope of Works

The scope of work for the project includes the construction of all new stormwater infrastructure and upgrading of the existing network as per the design drawings. The areas of focus in the current scope (TPT areas only) include the following in the Port of Saldanha:

- Tippler Area (5200157-2-001-C-LA-0002-01)
- Rail Embankment (5200157-2-001-C-LA-0003-01)
- Multi-purpose Terminal (5200157-2-001-C-LA-0004-01)
- Stockyard (5200157-2-001-C-LA-0001-01)
- Causeway (5200157-2-001-C-GA-0005-01)

4.4.2 Site Clearance, Earthworks & Layer works

4.4.2.1 Scope of Work

The scope of works for the site clearance, earthworks and layer works shall include the following:

- Clearing of all vegetation on site
- Cleaning and clearing of all existing stormwater infrastructure not being demolished or blocked off as per design drawings.
- Exposing and proofing of existing services on site
- Demolition and removal of existing stormwater pipes and manholes as indicated on the design drawings and demolition drawings.
- Demolition of all existing herbs along western side of main road to accommodate new grid channel and mountable kerb as per 5200157-2-001-C-LA-0002-01-RM, 5200157-2-001-C-LA-0002-02-RM, 5200157-2-001-C-LA-0002-03-RM, 5200157-2-001-C-LA-0002-04-RM.
- Materials bulk and restricted excavations
- Dewatering to ensure the site is dry enough for construction to be completed according to the design specifications and drawings (Contractor responsible for all dewater designs as per section 3.1.29)
- Shoring (Contractor responsible for all shoring designs as per section 3.1.29)
- Earthworks for excavation, layer works, bedding and backfilling of stormwater pipes manholes, infiltration trenches, channels, culverts, Subsoil Collector Drain (SCD), kerb and fillet/channel, concrete panels, pipe jacking, stilling basins, retention ponds, water filtration systems and any other stormwater infrastructure that forms part of the works.
- Rip and re-compact in-situ material.
- Construction of G2 base layer
- Construction of G5 subbase layer

- Construction of river sand layer and bedding
- Construction of uniformly graded aggregate layer.
- Construction of pea gravel layer
- Supply and install G-block paving with associated layer works as per 5200157-2-001-C-LA-0004-02
- Pond layer works as per drawing 5200157-2-001-C-DE-0001-01
- The supply and install of all HDPE geomembranes for ponds as per 5200157-2-001-C-DE-0001-01
- Infill and grading of existing pond at Tippler catchment as per drawing 5200157-2-001-C-DE-0002-01
- Final landscaping of embankments and ponds
- Grading of all ground surfaces towards stormwater infrastructure to encourage drainage as indicated on drawings.
- The disconnection, redirection, moving and reinstating off all existing services on site as indicated on the design and demolition drawings, or any other service that might be encountered when completing all stormwater works.
- Reinstatement of asphalt surfacing and concrete surfacing that were demolished and removed during construction.
- Any road markings and signage needed as a result of reinstatement of asphalt and concrete surfacing.
- Installation of 190m of W-Beam Steel Guardrail with approximately 51 wooden posts along the roadway at the Tippler embankment in accordance with SANS 1350 and SANS 457 (5200157-2-001-C-LA-0002-01).
- Pipe Jacking activity and all associated works as per SANS 1200 LG in the Rail Embankment area (5200157-2-001-C-LA-0003-01-RM) and Tippler area (5200157-2-001-C-LA-0002-01-RM) respectively as indicated on the design drawings.

And any other work arising out of or incidental to the above or required of the *Contractor* for the proper completion of the works.

4.4.2.2 Supporting Specifications

This section, "Site Clearance, Earthworks and Layer works", shall be read in conjunction with the following SANS and Transnet standard specifications.

SANS Specifications

S406	Specification for the supply of stone
SANS 1200 C	Site Clearance
SANS 1200 D	Earthworks
SANS 1200 DB	Earthworks (Pipe Trenches)
SANS 1200 DM	Earthworks (roads, sub grade)

SANS 1200 GM	Concrete (small works)
SANS 1200 M	Roads General
SANS 1200 ME	Subbase
SANS 1200 MF	Base
SANS 1200 MH	Asphalt surfacing
SANS 1200 MJ	Segmented paving
SANS 1200 MK	Kerbing
SANS 1200 MM	Ancillary roadworks
SANS 927	Precast concrete kerbs, edgings and channels
SANS 731	Road markings Part 1: Single-pack solvent-borne paints
SANS 1350	Guardrails for roads - W-section
SANS 457	Wooden poles, droppers, guardrail posts and spacer blocks
SANS 1091	National colour standard

4.2.2.3 Earthworks (SANS 1200 D)

Classification (Sub-clause 3.1)

Notwithstanding the provisions of sub-clause 3.1 of SANS 1200 D, the materials excavated will not be classified for the purposes of measurement and payment. The unit rate for excavation shall cover excavation in all materials other than hard rock.

Spoil site.

All excess material not spoiled to pre-loading areas within the port, shall be spoiled off site at the legal dump site at the earlier vicinity of the site. The *Contractor* is to make provision in his rates to haul and dispose of the spoil to the nearest Dump Site.

Where spoiling to a dedicated area for pre-loading is permitted on Transnet property, this shall be obtained in writing from the relevant Department by the *Project Manager*. The *Contractor* shall be responsible for hauling and levelling the spoil on site at the dedicated pre-load area.

Removal of Topsoil

Topsoil shall be stockpiled such that the stockpile shall not be disturbed during the construction of other services. Only topsoil that will be required for banks must be stripped and stockpiled to dedicated temporary area for re-use.

Removing Unsuitable Material

Any roadbed material which is considered by the *Project Manager* of quality that would be detrimental to the performance of the completed road shall be removed to widths and depths as instructed by the *Project Manager* and shall be disposed of as prescribed. The excavated area shall then be backfilled with approved imported material compacted to the required density.

Exposing existing services

Services are known to exist within the construction area. The *Contractor* must be in possession an Excavation Permit obtained from Transnet, prior to commencing any excavations.

Where services are positively identified and location known, these will be pointed out to the *Contractor* by the *Project Manager*.

The *Contractor* shall commence proof trenching to locate and identify services a minimum of 2 weeks prior to construction, to allow for relocation, protection and or amendments to the design of the works.

The *Contractor* shall plot and identify all services located and record these on the “As-built” copy of the Services Plan.

The *Contractor* shall assist when required where alterations to services are required by providing labour, plant and material to carry out the necessary work as instructed by the *Project Manager*.

Claims for extension of time will not be entertained as a result of locating or protecting existing services that is less than two weeks ahead of construction.

Responsibility for protection of all known services shall rest solely with the *Contractor*, who shall be responsible for all costs which may arise as a result of damage caused to such services or which may arise as a result of his negligence.

4.4.2.4 Materials and Layer works

- Bulk Excavation

The existing layers excavated for re-use shall be carted to a spoil site to be identified adjacent to the works.

- Disposal of material

All vegetation, trees, etc. resulting from site clearance shall be removed off site to the legal Dump Site. Haulage and disposal to this site shall be included in the rates. Burning of materials on site is not permitted.

- Preparation of Underlying Layer works

Existing base course material shall be uplifted and stockpiled and/or disposed of, as ordered by the *Supervisor*. The in-situ sand subgrade shall be compacted to 95% Mod AASHTO using large vibrating rollers of at least 10 tonnes.

Where permitted by the *Supervisor*, stockpiled base course material may be re-used for re-construction of the base course. Any shortfall in approved base course material shall be made up by importing class G2 material from commercial sources or making up deficiency by importation of dump rock on approval by the *Supervisor* on site. Compaction of the base course shall be by normal vibratory roller. Compaction densities shall be to a minimum of 98% of modified AASHTO density and be carried out at between –2% and +2% of the optimum moisture content.

The base course shall be kept continuously wet for a period of at least one hour before any concrete is placed. Immediately before the concrete is placed, the excess water shall be broomed off so as to ensure that the base course will still be damp when the concrete is placed, but no puddles of water or deleterious matter shall be left on the base course.

- Construction of Sub-base

Preparation and construction of the stabilized Sub-base shall be in accordance with the project specific and general standards and shall have the basic depths, proportions, tolerances, layouts and

compaction as indicated on the drawings. It is specifically designed to provide the foundation base to support the Base layer.

The G5 Sub-base material shall conform to the requirements of SANS 1200 ME shall be imported from a commercial source approved by the *Project Manager*.

- Construction of Base

Preparation and construction of the Base layers shall be in accordance with the project specific and general standards and shall have the basic depths, proportions, tolerances, layouts and compaction as indicated on the drawings. It is specifically designed to provide the foundation base to support the G-Block and/or concrete paneling.

The G2 Base material shall conform to the requirements of SANS 1200 MF shall be imported from a commercial source approved by the Project Manager.

- Installation of Edge Restraints

Preparation and construction of the Concrete Edge Restraints on the base layer shall be in accordance with the project specific and general standards to proportions, levels, tolerances, layout as indicated on the drawings. It is specifically designed to provide the foundation and lateral support base for the external edge of G blocks when laid.

Edge Restraints shall be constructed prior to installing G Blocks

- River Sand

The river sand shall be free from substances that may be deleterious to blocks and shall be in accordance with SANS 1200 MJ.

- Laying of G Block Paving

The units as supplied shall be free from cracks that detract from their general appearance. No unit with 15mm exceeding dimension shall be used or with covering more than 3% of the periphery of the surface that intend to be exposed. No unit shall have any protuberance of height exceeding 3mm. The surface texture and colour of the units shall fall within the range of texture and colour represented by the manufactures approved samples. The areas requiring G-block paving are as per the drawing 5200157-2-001-C-LA-0004-02.

- Construction of Kerbing and channel/fillet

Kerbs and channels shall be of the sections shown on drawings 5200157-2-001-C-DE-0003-03 and 5200157-2-001-C-LA-0004-02 and shall comply with the relevant requirements of SANS 927, when applicable, SANS 1200 MK.

- Construction of Subsoil Collector Drains

Subsoil Collector Drains shall be of the sections shown on drawings 5200157-2-001-C-DE-0003-03.

- Construction of grid and trapezoidal channels

Channels shall be of the sections shown on drawings 5200157-2-001-C-DE-0003-02 and 5200157-2-001-C-DE-0002-03 to the and shall comply with the relevant requirements of SANS 927, when applicable, SANS 1200 MK.

- Road markings

The Contractor shall provide all plant required to execute the works. The lines or markings are to be painted with Plascon - Hysheen Road and Runway Paint or similar approved, at an application rate the rate of 0,42 l per m². The colour of paint to be used shall be as specified in the Schedule of Quantities and indicated on the drawing issued. All paint shall conform to SANS 731-1.

The following must be noted by the Contractor in terms of SANS 731-1:

1. The paint shall be a Type 2 Paint
2. The paint shall be suitable for use in a parking area on a segmented concrete surface
3. The paint is not required to be retro reflective
4. Drying time classification shall be Class 1
5. The colours required for the completion of the contract shall be:
 - 5.1 White
 - 5.2 Red
 - 5.3 Golden Yellow (BS381C-356 or CKS 279 – D26)

All the above colours to meet classifications according to SANS 1091

- W-Beam Steel Guardrail

The Contractor shall construct the guardrail in accordance with SANS 1350 and SANS 457 and the project drawing (5200157-2-001-C-LA-0002-01). The 51 wooden posts are to be spaced approximately 3.810m and the W-Beam steel guardrail ends are to be bullnose end wing specification. The road barrier is to be placed at least 0.5m from the road edge.

4.4.3 Stormwater Drainage Works

4.4.3.1 Scope of Work

The scope of work for the construction of stormwater drainage systems for this project shall include for the delivery to site, off-loading and storage on-site, setting out, execution of the works, testing, commissioning and handing over of new stormwater drainage infrastructure and connecting to and upgrading and repairing of all relevant existing networks as per the designs.

The stormwater drainage *works* shall include the following:

- Locate and prove all existing stormwater infrastructure on site.
- Contractor shall plan the construction sequence of the new stormwater infrastructure and how it will tie into existing infrastructure. The order of demolition, construction and connections should be approved by the Supervisor before any construction commences.
- Excavation, layer works, bedding and backfilling of stormwater infrastructure.
- Supply and install new class 100D concrete pipes.
- Supply and install new 200mm UPVC pipes from stilling basin to filtration system and connection manhole as detailed on 5200157-2-001-C-LA-0004-01-01.
- Supply and install new perforated UPVC pipes in SCD for the Rail Embankment area as per drawings 5200157-2-001-C-DE-0003-03
- Supply install new perforated UPVC pipes for the Causeway area as per 5200157-2-001-C-LA-0005-01, 5200157-2-001-C-LA-0005-02 and 5200157-2-001-C-LA-0005-03
- Supply, install and connect 140mm Class 16 uPVC pipe to redirect rising sewer main around Pond 12 to sewer pump 3. See layout drawings 5200157-2-001-C-LA-0003-01-RM, 5200157-2-001-C-LA-0003-02-RM and 5200157-2-001-C-LA-0003-03-RM for more information.
- Supply, install, construct, connect and redirect communications lines and manholes around Pond 12. See layout drawings 5200157-2-001-C-LA-0003-01-RM, 5200157-2-001-C-LA-0003-02-RM and 5200157-2-001-C-LA-0003-03-RM for more information.
- Supply, install, construct, connect and redirect electrical lines using Wire Steel Armored cable (WSA) around Pond 1 as per SANS 10142. See layout drawings 5200157-2-001-C-LA-0002-01-RM, 5200157-2-001-C-LA-0002-02-RM, 5200157-2-001-C-LA-0002-03-RM and 5200157-2-001-C-LA-0002-04-RM.
- Construct new stormwater manholes and catchpits and the connection of new and existing infrastructure to the manhole as per the design drawings.
- Construct new stormwater channels and tie-ins.
- Construct new subsoil collector drains. See layout drawings 5200157-2-001-C-LA-0003-01-RM, 5200157-2-001-C-LA-0003-02-RM and 5200157-2-001-C-LA-0003-03-RM for more information. Track work shall comply to Manual for Track Maintenance 2012.
- Supply, install and construct of new precast SATS Class 1 portal culverts and precast bases as per 5200157-2-001-C-LA-0002-01-RM, 5200157-2-001-C-LA-0002-02-RM, 5200157-2-001-C-LA-0002-03-RM, 5200157-2-001-C-LA-0002-04-RM, 5200157-2-001-C-LA-0003-01-RM, 5200157-2-001-C-LA-0003-02-RM and 5200157-2-001-C-LA-0003-03-RM.
- Supply, install and construct new grid channel along main road as per as per 5200157-2-

001-C-LA-0002-01-RM, 5200157-2-001-C-LA-0002-02-RM, 5200157-2-001-C-LA-0002-03-RM, 5200157-2-001-C-LA-0002-04-RM.

- Construction of new mountable kerb on edge of Main Road to new rail embankment MH1.
- Excavation, layer works, backfilling and placement of geomembranes for retention ponds as per the design drawings
- Excavation, layer works, backfilling and placement of geo-textiles for infiltration trenches as per 5200157-2-001-C-LA-0005-01, 5200157-2-001-C-LA-0005-02 and 5200157-2-001-C-LA-0005-03
- Excavation, layer works, backfilling and construction of stilling basins as per 5200157-2-001-C-LA-0004-01-01 and 5200157-2-001-C-LA-0004-01-02
- Excavation, layer works, backfilling, supply, installation and connection of new filtration systems for stilling basins as per 5200157-2-001-C-LA-0004-01-01 and 5200157-2-001-C-LA-0004-01-02
- Pipe jacking for proper completion of all stormwater drainage works as per 5200157-2-001-C-LA-0002-01-RM, 5200157-2-001-C-LA-0002-02-RM, 5200157-2-001-C-LA-0002-03-RM, 5200157-2-001-C-LA-0002-04-RM, 5200157-2-001-C-LA-0003-01-RM, 5200157-2-001-C-LA-0003-02-RM and 5200157-2-001-C-LA-0003-03-RM.
- Cleaning, clearing, repairing and reinstating of all existing stormwater infrastructure including, but not limited to, pipes, culverts, channels, manholes, down chutes and ponds as per the designs.
- Reinstating and connection of new infrastructure to existing infrastructure as shown on design drawings.
- Blocking off of existing manholes, pipes and outlets as per drawing.

And any other work arising out of or incidental to the above, or required of the *Contractor* for the proper completion of the *works*.

4.4.3.2 Supporting Documents

This section, "Stormwater Drainage", shall be read in conjunction with the following SANS and Transnet standard specifications.

SANS 1200 DB	Earthworks (Pipe Trenches)
SANS 1200 LB	Bedding (Pipes)
SANS 1200 MK	Kerbing
SANS 1200 L	Medium Pressure Pipelines
SANS 1200 LB	Bedding Pipes
SANS 1200 LC	Cable Ducts
SANS 1200 LG	Pipe Jacking
SANS 1200 LD	Sewers
SANS 1200 LE	Stormwater

SANS 927	Precast concrete kerbs, edgings and channels
SANS 667	Pre-cast Concrete Pipes
MTM, 2012	Manual for Track Maintenance
Version 1.2.2.20	Stormwater Filtration System Specification Heavy Metals Filtration System Guidelines and Experiences

4.4.3.3 Materials

The supply and delivery to site of all storm water pipes shall conform to specifications of SANS 677.

4.4.3.4 Brickwork Manholes and Catch Pit's

The construction of the brickwork manholes and Catch Pit's shall conform the specifications and requirements detailed in the drawings 5200157-2-001-C-DE-0001-02, 5200157-2-001-C-DE-0001-03.

All brickwork shall be built in manhole bond i.e. stretchers only on the inside face, using cement mortar as specified. Bricks shall be well soaked before use and the previous course shall be wetted before bricks are laid thereon.

All joints on the internal face (and the external face above ground) shall be half round recessed. and shall be well rubbed with a standard jointing tool of suitable size to ensure that the entire exposed surface on the joint presents a smooth and polished appearance.

Intersecting walls shall be properly toothed with each other, and all angles levelled and plumbed. Should cement bricks be utilized, then all internal surfaces shall be plastered with a 12mm thick. 3:1 cement sand mortar mix.

When brick built' manholes are constructed in wet ground, the external surfaces shall be rendered. with 12mm thick 3:1 cement sand mortar mix.

4.4.3.5 Pipe crossings

Where pipes cross with a vertical height difference of less than 150mm, a polystyrene block. spacer shall be placed between the pipes.

The fill material around the pipes shall be thoroughly moistened and compacted.

The *Contractor* will be held responsible for any damage to pipes resulting from the construction. of a pipe crossing.

4.4.3.6 Plant

The *Contractor* shall ensure that only plant suitable for working in the confined limits of the site of *works* and able to obtain the required specification of layer works is used.

4.4.3.7 On-site Storage

The *Contractor* shall be allocated a storage area on site and shall be responsible for all materials stored on site until such time that the water main has been tested and handed over to the *Employer*.

Pipes should be stored on level ground that is free from stones and sharp objects and should be so stacked (in a stack of cross formation) that the load on each pipe is uniform throughout its length.

Socketed pipes should be stacked that the sockets are at different ends in each alternate layer and protrude from the stack.

The height of the stack should not exceed 1m, and pipes of different diameters and class should not be stacked together. Protective packing should not be removed until immediately before use.

4.4.3.8 Cut pipe ends.

Ends may be cut on site using the appropriate cutting machinery. Reinforcement exposed by such cutting is to be protected with 20mm thick cement mortar as well as corrosion protection specified in section 4.5.8 of this document.

4.4.3.9 Pipe Laying and Jointing

Pipes that have been exposed for several hours to direct sunlight and have become hot should not be laid until they have cooled to a temperature of approximately 25°C.

Rubber ring jointing may be carried out in the trench. The pipeline should be laid directly on to the prepared bedding in the trench, and bricks or other hard bodies must not be placed under the pipeline for either temporary or permanent support. Rubber rings used must be those supplied by the pipe or fitting manufacturer. All spigots must be checked to ensure that they are free from burrs, and spigots, sockets and rings must be cleaned with a dry cloth. The pipe end must be chamfered to an angle of approximately 15° and the depth of entry must be marked on the spigot. This mark must be so positioned as to allow a 6mm clearance between the spigot and the bottom of the socket. A thin film of a lubricant recommended by the manufacturer should be applied to each rubber ring and each spigot.

4.4.3.10 Pipe Jacking

The scope of work includes pipe jacking as denoted on the drawings and any other work arising out of or incidental to the above or required of the *Contractor* for the proper completion of the works.

- Supporting Specifications

This section, "Pipe Jacking", shall be read in conjunction with the following SANS specifications.

SANS	
SANS 1200 DA	Earthworks (small works)
SANS 1200 DB	Earthworks (Pipe trenches)

SANS 1200 LG	Pipe jacking
SANS 667	Concrete Non-pressure Pipes

- Materials and Workmanship

Pipes for Jacking

Pipes for jacking shall be SC Type reinforced concrete manufactured in accordance with SANS 677: All pipe joints shall be sealed. The actual diameter of the pipes shall not be less than the nominal diameter given on the drawings or stated in the schedule.

In addition to withstanding the specified two (or three), edge bearing test-load, the pipes shall be capable of withstanding, without damage during jacking, the maximum longitudinal force to be transmitted by the *Contractor's* jacks and method of installation.

The design of the pipes shall be determined by the *Contractor* to suit the proposed method of construction but shall not be less than the class of pipe or type of pipe stated on the drawings or determined by the Engineer. The pipes shall incorporate extended modified Ogee type joints which shall be seated by means of a rubber ring. On the longer pipe jacks it may be necessary to use a rebated butt joint to withstand the higher jack forces. However, the decision of type of joint to use is that of the *Contractor*. Irrespective of joint type used the *Contractor* must adhere to the joint sealing details given below.

At least one hole shall be formed in the crown of each pipe to allow for the injection of both a lubricant, if required, and a final grout. The final layout of grout holes is the *Contractor's* responsibility.

The *Contractor* must ensure that the pipes shown on the drawings and mentioned in the documents can be jacked the full distance mentioned in the Scope of Work.

- Intermediate Jacking Pipes

In circumstances where it is desirable to use jacking pipes intermediate between manholes or junctions the number and type of such intermediate jacking pipes is to be determined by the *Contractor*. The joint between pairs of intermediate jacking pipes shall be protected externally by a cylindrical mild steel sleeve of wall thickness at least 8mm, which shall overlap the pipes on either side of the joint for a distance of at least 150mm. The joint is to allow a substantial and permanent caulked seal within the joint.

Full details of the intermediate jacking pits and the junction box constructed as a closure between the ends of the jacked pipes are to be submitted with the tender.

- Joints and Seals

It is the *Contractor's* choice as to type of joint used in the pipes to be jacked. However, applied forces used to jack the pipes must be uniformly distributed around the joint to avoid damaging the joint. Pipes that are delivered to site with damaged joints must be rejected by the *Contractor*.

A seal is required at each joint to minimize ingress of water. Ingress of water into the jacked pipes stemming from the joints should not exceed 5 liters per minute in total. The chipboard packing used

to distribute stresses on the joints should be raked out to a depth of 25mm on the inside all round and sealed with a durable flexible sealing agent such as bituseal, thioflex or similar approved.

- Construction

Authority to Jack Pipelines under Roads and Railway Lines

The *Employer* will obtain permission from the relevant authorities for jacking under roads and railway lines. However, the *Contractor* is to confirm that such permission has been granted before commencing work.

- Competence

Jacking and excavation shall be supervised and undertaken by persons fully conversant with this work.

- Contractor Solely Responsible

No approval of any material or plant and its operation or of any construction procedure to be used will imply any relaxation of the requirements governing the quality of the materials or of the finished work or relieve the *Contractor* of his responsibilities under the Contract.

- Recording Movements

General

The *Contractor* shall take movement measurements correct to 1,0mm of any change in the line and level of roads, rail tracks and rail formation level before the start of the contract and at such intervals as directed by the Engineer for a period up to 12 months after issue of the Completion Certificate. However, no more than 15 sets of reading will be required in this period. A copy of these measurement records shall be made available to the Engineer. Appropriately constructed and marked benchmarks and measurement-stations as directed by the *Engineer* shall be established.

- Working under/above services

The *Contractor* shall prove all existing services for the fulfillment of the jacking activity. The Contractor shall bear full responsibility for any consequential damage to persons and property resulting from jacking activity.

- Working under Roadways

The *Contractor* shall bear full responsibility for any consequential damage to persons and property resulting from subsidence.

- Working under Railway Lines

The relevant clauses of the Wayleave agreement and specifically those related to pipe jacking / directional drilling shall be complied with. Wayleave to also have co-signature of approval by local signal personnel.

Before jacking under railway lines, the *Contractor* shall take elevation readings at the top (Crest) of the fill embankment, or the toe of cuttings, and at the toe of the ballast as well as on top of each railway line along the centre line of the pipe jack and at intervals of 1 500 mm apart up to a distance

of 9m from the pipe centre line. The profile of the railway embankment must be measured and recorded from toe to toe (of the embankment) before pipe jacking starts.

The intervals at which movement readings are to be taken over a period of 12 months is the same as mentioned above for roads.

Remedial Measures

All remedial measures will be carried out and completed to the standards set by the various controlling authorities.

Roads – remedial measures plus time related professional costs needed to reinstate roads and fill embankments will be the *Contractor's* liability.

Remedial measures are those relating to the need to put right settlement and movement of road surfaces, formation layers or fill embankments including providing all road safety markers, traffic control, or signs and all associated needs of the road authority to allow remedial work to proceed without danger to workers or traffic. The *Contractor* must arrange all matters regarding remedial work with the road authority. In most instances these measures will comprise jacking up concrete roads using grout and re-grading to original elevation formation layers and premix surfacing as well as mending drainage fixtures where these have been damaged. All the remedial work will be directed by the Engineer to his satisfaction and approval.

Railways – remedial measures plus time related professional costs needed to reinstate railway lines and fill embankments will be the *Contractor's* liability.

Remedial measures are those relating to the cost of realigning railway lines, re-grading of ballast, and stabilizing fill embankments. All the remedial work will be directed by the *Engineer* to his satisfaction and approval.

- Excavation

General Except as required in terms of 5.2.5 SANS 1200 LG 1983 the provisions of SANS 1200 DA shall apply.

- Thrust Pits

Claims arising out of any accidents or incidents in or adjacent to these access pits will not be considered by the Employer.

Stormwater control measures around these pits are also necessary to prevent water ingress into the pits. Provision must be made by the *Contractor* to keep both thrust and reception pits free of seepage and stormwater.

Thrust pits will in general only be permitted at positions indicated on the drawings or where manholes or junctions are required. Jacking pits shall be of sufficient size to accommodate the jacking operation and any manhole structure to be constructed upon completion of the jacking. The approximate dimensions of the pits shall be agreed with the Engineer before work commences. The *Contractor* will be required to design and construct all thrust blocks, bases and other temporary works required to maintain the stability of the pits and shall demolish and remove these upon completion of the jacking operation and the *Contractor* shall take into account all such limiting factors when preparing his/her tender.

- General

A lead pipe with a rebated front end over which the trailing end of the shield is fitted should be the first concrete pipe used. This should minimize overbreak. No material may be removed in advance of the leading edge of the shield in unstable or loose materials.

As the pipe is advanced, excavation is to take place within the lead pipe under the full-time supervision of a responsible foreman to ensure that the end of the shield is always fully plugged with earth at a safe angle of repose within the pipe. The *Contractor* shall ensure that there is not uncontrolled flow of sand, mud or earth into the pipe which could result in impeding excavation personnel or the formation of cavities above or around the sleeve pipe. If at any stage during the jacking operation such conditions arise the *Contractor* shall immediately plug the pipe and stabilize the material before proceeding with further work.

Should it be necessary, the *Contractor* shall allow for stabilizing the soil by dewatering, chemical grouting, or any other approved means. The design of the shield shall be such as to permit the face to be completely or partially closed by boarding or similar to control material flow from the face.

During weekend or holiday stoppages the *Contractor* must make sure that a plug of soil is left in the shield.

- Continuous Jacking

In order to minimize problems due to the build-up of skin friction on a static pipe, the pipes are to be jacked continuously unless agreed to otherwise with the Engineer, allowing for overnight stoppage.

- Jacking Procedure

Each jack shall be fitted with a pressure gauge suitably calibrated such that the actual jacking forces can be read at any time.

Suitable packing of hard materials shall be inserted between the abutting vertical ends of the pipes in order to transfer the jacking force. The packing shall constitute a complete circle and be sufficiently wide to transfer the applied load.

A suitable adjustable shield is to be fitted to the front of the lead pipe. The shield is to incorporate cutting edges which can be varied by control jacks to maintain the pipe online and level.

Pipe jacking may generally be carried out either upgrade or downgrade to suit the *Contractor's* requirements subject to the approval of the Engineer, and provided that provision is made by the *Contractor* for the necessary drainage required.

- Lubrication of Structure during Jacking

To ease pipe friction, the *Contractor* shall make provision for the injection of bentonite or other approved lubricant.

- Backfilling

Both thrust and reception pits must be backfilled using the removed material. Backfill compaction rates must not be less than 90 percent Modified AASHTO with the top 1,5m of backfill being compacted to a minimum 92% Modified AASHTO. The backfill must be built up to at least 500mm above the natural ground level to prevent stormwater pounding around the excavation pits.

- Grouting and Plugging

In soft material the grout shall consist of cement/bentonite with a compressive strength of 5MPa at 28 days. In hard material and rock the grout shall consist of cement/sand with a compressive strength of 25 MPa at 28 days.

- Markers

On completion of the backfill the Contractor must place a marker concrete post (pre-stressed lintel) into the ground directly above the centre line of the pipe at the entrance. The post must stick 1,0m above the ground and at least be buried 1,5m in the ground. The top 0,5m of the post must be painted bright red.

- Measurement

Throughout the jacking operation the Contractor is requested to take and record the following measurements.

A plot of pressure (kN/m²) and total force (kN) originating from the combined force of all hydraulic jacks used to move pipes versus accumulative length of jacked pipe. As soon as a lubricant is used it must be recorded on the plot. If heavy ground water seepage is noted this must also be recorded on the plot. A time scale in days should also be used in conjunction with jacked length of pipe. It is also important to record start up force required to move pipes after a delay, i.e. after weekend.

The dimensions of the thrust block used must be recorded as well as the accumulative thrust force on the block (kN) together with lateral movement of the thrust block (mm).

- Subsoil Collector Drain

The placement of the Subsoil Collector Drain must be confirmed on site and should not affect the rail formation.

4.4.3.11 Sewer, Comms and Electrical service relocation

- Electrical and Comms Service relocation

Unless otherwise directed by the Supervisor, the ducts shall be laid as shown on the standard drawings of the Standard Specification.

All electrical cable ducts are to be laid approximately 800mm below finished road level and the pipes must protrude 500mm beyond the edge of the hardened roadway or stormwater drain. Both ends of each duct must be sealed with an end cap. The position of each duct crossing shall be indicated on site using suit-able markers.

Draw wires must be provided in each duct and duct ends must be sealed with suitable stoppers. A double strand copper wire of at least 2,8mm² cross section that will serve as a screen and is to be installed approximately 200mm above all ducts over its entire length.

- Electrical and Comms manholes

All brickwork shall be built in manhole bond i.e. stretchers only on the inside face, using cement mortar as specified. Bricks shall be well soaked before use and the previous course shall be wetted before bricks are laid thereon. All joints on the internal face (and the external face above ground) shall be half round recessed and shall be well rubbed with a standard jointing tool of suitable size to ensure that the entire exposed surface on the joint presents a smooth and polished appearance. Intersecting walls shall be properly toothed with each other, and all angles levelled and plumbed. Should cement bricks be utilized, then all internal surfaces shall be plastered with a 12mm thick 3:1 cement sand mortar mix.

When brick-built manholes are constructed in wet ground, the external surfaces shall be rendered with 12mm thick 3:1 cement sand mortar mix.

Where area adjacent to rail will be concrete surfaced the equivalent length will require signal cable pipes with manholes or possibly shared with electrical manholes. 3 x 120mm flex tubes required especially at level crossing areas if no alternate route for signal cable exist.

- Sewer Main Service relocation

Scope of works for sewer relocation:

- To accommodate the location of Pond 12, the rising sewer main leading to pump 3 as indicated on the Rail Embankment drawings will need to be relocated.
- Construction of sewer manholes
- Tie into existing sewer main network.

- Sewer Manhole

This section, "Sewer Main Service Relocation", shall be read in conjunction with the following SANS standard specifications.

Table 3 – Sewer/Effluent SANS standard specifications

SANS	
SANS 1200 DB	Earthworks (Pipe trenches)
SANS 1200 LB	Bedding (Pipes)
SANS 1200 LD	Sewer/Effluent Drainage

- Materials

Class 16 uPVC pipes to the diameter and length as stated on the drawings are to be used for sewer/effluent reticulation from downpipes and also the sewer/effluent network.

Construction of Sewer Manholes

- Brickwork Manholes

All brickwork shall be built in manhole bond i.e. stretchers only on the inside face, using cement mortar as specified. Bricks shall be well soaked before use and the previous course shall be wetted before bricks are laid thereon. All joints on the internal face (and the external face above ground) shall be half round recessed and shall be well rubbed with a standard jointing tool of suitable size to ensure that the entire exposed surface on the joint presents a smooth and polished appearance. Intersecting walls shall be properly toothed with each other, and all angles levelled and plumbed. Should cement bricks be utilized, then all internal surfaces shall be plastered with a 12mm thick 3:1 cement sand mortar mix.

When brick built' manholes are constructed in wet ground, the external surfaces shall be rendered with 12mm thick 3:1 cement sand mortar mix.

- Pipe crossings.

Where pipes cross one another with a vertical height difference of less than 150mm, a polystyrene block must be placed between them, and the fill material around the pipes thoroughly moistened and compacted. The *Contractor* will be held responsible for any damage to pipes resulting from the construction of a pipe crossing.

Cut pipe ends.

All ends may be cut on site.

4.4.4 Concrete Works

4.4.4.1 Scope of Work

The scope of work for concrete works shall include the delivery to site of all materials necessary to complete the *works*, off-loading on site, storage on-site, setting out, construction, installation, testing, commissioning and handover.

The *works* includes for the following:

- Earthworks, excavation, dewatering, preparation of base and foundations
- Reinforcement and formwork
- Casting of concrete
- Construction of concrete panels
- Construction of all manhole bases for pipework and culverts
- Construction of concrete cover slabs for manholes: sewer, stormwater electrical and communication
- Construction of new V-drain as per 5200157-2-001-C-LA-0005-02
- Construction of concrete stormwater channels, 473m of trapezoidal channels (5200157-2-001-C-DE-0002-02-RM), channel tie into Pond 4 (approximately 10m), grid channels (5200157-2-001-C-DE-0003-02-RM) and any other stormwater infrastructure to complete the works as per the designs.
- Construction of concrete encasement of all pipework as per the design drawings and notes
- Construction of headwall and scour protection for each pond as per design drawings.
- Construction of all bases, walls and covers of new stilling basins as per structural drawings.
- Supply and install new filtration system precast circular manholes, bases and covers as per 5200157-2-001-C-LA-0004-01, 5200157-2-001-C-LA-0004-02 and 5200157-2-001-C-DE-0004-01
- Supply and installation of cascade chutes to extend to existing trapezoidal channel approximately 6m as per 5200157-2-001-C-LA-0002.
- Repair of existing grid channels, covering grids and concrete channels (Contractor to perform inspection on the condition of all existing channels and covers and to be agreed by the Supervisor)

And any other work arising out of or incidental to the above, or required of the *Contractor* for the proper completion of the *works*.

Particular Specifications

The following specifications shall apply:

NB: All in situ concrete work (mass and reinforced) shall comply with SANS Specification 1200G ("8 Measurement and Payment" is not applicable) supplemented by the clauses in this section. Where SANS Specification 1200G and the clauses in this section are in conflict the clauses in this section shall take precedence.

In addition, the "Model Preambles for Trades" as recommended and published by the Association of South African Quantity Surveyors, 1999 Edition, shall be read in conjunction with and shall apply to all items in the Bill of Quantities not covered by the 'SANS Standardized Specifications' SANS 1200 Series

Where the term "plain concrete" appears in SANS Specification 1200G it shall be read as "mass concrete".

SANS Specifications	
SANS 1200 G	Concrete Structural
SANS 2001: CC1	Construction Works: Concrete Works (Structural)
SANS 1083:1994	Aggregates from natural sources
SANS 10100-2:1992	The Structural use of concrete – Part 2: Materials and execution of work
SANS 50197-1	Cement – composition, specifications, and conformity criteria. Part 1: Common cements
SANS 1491-1	Portland cement extenders – Part 1 Ground granulated blast furnace slag
SANS 1491-2	Portland cement extenders – Part 2 Fly ash.
SANS 1491-3	Portland cement extenders – Part 3 Condensed Silica Fume
SANS 110	Sealing compounds for the building industry, two component, polysulphide base
SANS 1023	Preformed Elastomeric Compression Joint Seals
ASTM C309	Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
BS 8110 Part 1	Structural use of Concrete
AASHTO M153	Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

Cementitious Binders

Coastal Zone

As the *Works* are within one kilometer from the sea, one or more of the following cementitious binders shall be used in all concrete applications.

- Blast furnace cement, Type III/A, certified as containing not less than 40% and not more than 50% milled granulated blast furnace slag (MGBS), or A blend of Type 1 Portland cement with not less than 40% and not more than 50% MGBS. MGBS shall comply with SANS 1491 Part 1., or
- Fly ash cement Type II/B-V or Portland fly ash cement Type II/B-W certified as containing not less than 25% and not more than 30% fly ash shall comply with SANS 1491 Part 2.

Total Salts, sulphates and acids in cement stabilised layers

Pavement layers stabilized with cement may be damaged by salt crystallization, sulphate attack and acid, all of which can lead to a complete loss of cementation and/or excessive heaving and cracking. The following recommendations are applicable before stabilization:

Total salts (conductivity):

Base and subbase: 0.15 S/m (max) at 25degrees Celsius.

Selected subgrade: 0.40 S/m (max) at 25degrees Celsius

Sulphates (all layers)

- a) The maximum acid-soluble sulphate content of materials to be stabilized with cement or lime should not exceed 0.25% calculated as SO₃ if the PI exceeds 8 or the percentage passing the 2µm exceeds 12. A maximum of 1% is permissible for materials with lower PIs and clay content.
- b) The maximum water-soluble sulphate content of all materials within 500mm of any stabilized layers should not exceed 2.5g/l of SO₃. If a 2:1 water: soil ratio is used, a limit of 2g/l should be used.

Acid (all layers):

A minimum pH of 6.0 is required for all materials to be stabilized with cement or lime and the stabilized layer must not be closer than 500mm to acidic materials with a Ph of less than about 6.

Cement

- Common cements, complying with SANS 50197-1 shall be used for all concrete work. On no account shall masonry cements be used for concrete work, even if the strength designations are the same as for common cements.
- The Supervisor for test purposes may require samples of cement from anyone, or from every consignment. Cement in any consignment from which a sample may have been taken for testing shall not be used until it has been approved. Allowance must be made for possible delay in that tests may take 10 days to carry out.
- Bags of cement shall be stacked in a waterproof, solidly constructed shed with a central door and a floor rendered damp-proof with a tarpaulin. The bags of cement shall be closely stacked (but not against walls) in order to reduce air circulation in such a manner that the cement is used in the order in which it was received, i.e. first in first out.

Alkali Reactive Concrete

Alkali Reactive Aggregates shall not be used in this project. The equivalent Na₂O content of the concrete shall not exceed 2,0 kg/m³ where % Na₂O equivalent = % Na₂O + (0,658 x %K₂O)

Aggregates

Fine and coarse aggregate shall comply with the relevant clauses of SANS 1083.

Where aggregates have constituents, which in the opinion of the *Project Manager*, may give rise to damage due to alkali-aggregate reactions, the provisions of 6.3.3.3 shall be applicable.

Evidence of compliance of the aggregates with the requirements of 6.3.3.1 & 6.3.3.2 shall be furnished as early as practical. No aggregate shall be delivered for use in the works until approval is given. Sand (fine aggregate):

The fine aggregates shall comply with the requirements of SANS Specification 1083. Other aggregates may be approved if they have a satisfactory history and / or test results.

No aggregate may be used until it has been approved. Samples having a mass of 25kg.

(16.5 liters) of the proposed aggregate to be used may be required by the Supervisor for test purposes. Samples having a mass of 25kg shall be forwarded every 3 months during concreting work and also if the source of supply is changed. Allowance must be made for possible delay in that the tests may take 14 days to carry out.

Admixtures

Admixtures containing chlorides will not be permitted in reinforced concrete. Where applicable, and as indicated on the drawings, water-retaining structures shall have 'Penetron Admix' as an additive to the concrete mix to 0.8% of cement content by weight by a certified Penetron batching plant or similar approved.

Cover Blocks

Cover blocks used to ensure the cover to reinforcement shall be made of cement mortar.

Cover blocks shall be dense and have a minimum 28 day crushing strength of 50 Mpa and shall be cured in water for at least 14 days before being used.

Cover/spacer blocks made of plastic will not be permitted.

Concrete Quality

Prior to the start of any concrete work on site, the *Contractor* shall submit a quality assurance plan which will ensure compliance with specification and provide acceptable documentary evidence that all specified operations have been carried out satisfactorily.

Where the minimum dimension to be placed during a single pour is larger than 600mm, and the cement content of the reinforced concrete exceeds the following:

- Cement Types I and II/ * S : 400 kg/m³
- Cement Types II/B-V and II/B-W : 450 kg/m³

The *Project Manager* may require that measures be instituted to reduce heat development in the concrete.

Unreinforced concrete

Class A Concrete:

Filling to cavity of hollow walls.

Unreinforced concrete cast against excavated surfaces

15 Mpa/19mm Concrete

Surface blinding under footings and bases.

Reinforced concrete

40 MPa/19mm Concrete:

Bases.

Foundation beams.

Surface beds cast in panels on waterproofing.

Walls in foundations (Provisional).

Columns in foundations (Provisional).

Unless otherwise specified or detailed on the drawings.

Batching

All cementitious binders shall be matched by full sack or by mass batching with approved precision.

weighing equipment. All aggregates shall be precisely measured by mass using approved precision weigh-batching, equipment, unless otherwise approved by the *Project Manager*.

Should any variation in the composition of the aggregate become apparent, the *Project Manager* shall be notified and a further sample of aggregate submitted immediately for his approval.

Concrete Placing

The *Project Manager* shall approve the size, shape and depth of any excavation before concrete is placed. Unless otherwise approved by the *Project Manager*, no concrete shall be placed until the fixed. Reinforcement has been accepted and confirmed in writing by a Release Certificate signed off by:

- The Supervisor
- The Surveyor - It shall be the responsibility of the *Contractor* to call the Surveyor prior to pouring concrete to verify and confirm all levels, co-ordinates and alignment of the structure to be cast.

No concrete shall be placed unless both the above signatories appear on the Pour Release Certificate.

Construction Joints

Unless otherwise shown on the drawings, the exact position of horizontal construction joints shall be marked on the formwork by means of grout checks in order to obtain truly horizontal joints.

Stub columns, stub walls and stays on footings shall be cast integrally with the footing and not afterwards, even where another class of concrete is being used. Joint lines shall be so arranged that they coincide with features of the finished work.

Where new concrete is to be cast against a hardened concrete surface, neat cement slurry mixed to a creamy consistency shall be brushed onto the cleaned concrete surface.

Contraction joints shall be smooth and shall have one coat of lime wash or PVA applied to the older surface prior to casting the fresher concrete.

Slip Joints between Concrete and Brickwork

Slip joints shall be provided between brickwork and concrete slabs and beams by levelling up and towelling smooth the bearing surfaces of brickwork with 3:1 cement mortar and covering the bearings before the concrete is based, with two layers of one side smooth tempered hardboard, with the smooth sides in contact.

The ends and sides of beams and edges of concrete slabs shall be separated from the brickwork with 13mm thick bitumen impregnated soft board or expanded polyethylene strips placed vertically against the brickwork before the concrete is cast.

Similar slip joints shall be provided between brickwork and concrete lintels cast in situ, but without soft board or expanded polyethylene strips at ends.

Movement Joints

All movement joints are to be filled in with approved bitumen impregnated soft board or expanded polyethylene strip unless otherwise specified or detailed on drawings. Descriptions (prices) of movement joints shall be deemed to include formwork.

Grouting

25 MPa non-shrink cementitious grout:

Bedding approximately 25mm thick under base plate including chamfered edges all round.

Curing Compound

Unless otherwise directed by the *Project Manager*, the curing compound shall be:

An approved trafficable, resin-based, white pigmented, membrane forming for slopes flatter than 1:1.

An approved clear, aesthetically acceptable, membrane forming for all other concrete surfaces, including beam and slab soffits.

The curing compound shall comply with specification ASTM C309, except that the maximum permissible water loss in the test shall be 0,40 kg/m².

Alternatively, the curing compound shall be acceptable if the treated concrete retains 90% or more of its mixing water when subject to the test set out in BS 8110 Part 1 – Chapter 6.6.

Curing Compound Application

The total application rate of the curing compound shall be the greater of the supplier's specification or 0,90 l/m². On textured concrete surfaces, the total application rate shall be 0,90 l/m².

In cases of concrete surfaces with run-off problems, it may be necessary to apply more than one coat of membrane forming curing compound to obtain the specified total or cumulative application rate.

Curing in accordance with SABS 1200 G shall commence on all concrete surfaces as soon as it is practical in the opinion of the *Supervisor*.

On unformed surfaces the curing compound shall be applied after finishing and as soon as the free water on the surface has disappeared and no water sheen is visible, but not so late that the liquid curing compound will be absorbed into the concrete.

On formed surfaces, the exposed concrete shall be wet with water immediately after the forms are removed and kept moist until the curing compound is applied.

Application of the curing compound shall begin once the concrete has reached a uniformly damp appearance with no free water on the surface.

Application of the compound may be done by hand or power spray.

The compound shall be applied at a uniform rate with two applications at right angles to each other to ensure complete coverage.

Pigmented compounds, without a thixotropic agent, shall be adequately stirred to assure even distribution of the pigment during application.

Unless otherwise directed by the *Supervisor*, the initial 24 hour curing of concrete surfaces not covered by formwork shall be carried out by ponding, covering with constantly wetted sand or mats, or continuous spraying in accordance with SABS 1200 G when the following climatic conditions occur:

Wind velocity greater than 5 m/s.

and/or

Ambient temperature is above 25 °C.

and/or

The relative humidity is below 60 %.

If plastic shrinkage occurs, the concrete, while still plastic, shall be re-vibrated, floated and recoated with curing compound as if no curing has previously taken place.

Curing Period

The curing period for concrete containing only CEM 1 shall be 7 days.

The curing period for concrete containing CEM 1 plus cement extenders (MGBS, FA) shall be 10 days. The curing period will start on completion of the concrete pour and for formed surfaces shall include the time for which forms are still in place after the pour.

Concrete Records

The *Contractor* shall maintain the following daily records for every part of the concrete structure and shall make these available at all times during the progress of the work for inspection by the Supervisor or *Project Manager*.

- The date and time during which concrete was placed.
- Identification of the part of the structure in which the concrete was placed.
- The mixed proportions and specified strength
- The type and brand of cement
- The slump of the concrete
- The identifying marks of test cubes made.
- Curing procedure applied to concrete placed.
- The times when shuttering was stripped, and props removed.
- The date of dispatch of the cubes to the testing laboratory
- The test results.

The records shall be delivered to the *Project Manager* each week except in the case of substandard concrete, when the *Project Manager* shall be informed immediately.

Tolerances

Deviations shall be within the limits listed in SANS 1200 G for degree of accuracy II unless otherwise specified.

Testing and Monitoring

Frequency of sampling and testing shall be as specified in SANS 1200 G.

- If the quantity of concrete from which samples were taken exceeds 40 m³, it shall be subject to the testing of a minimum of 3 sets of samples per day from each grade of concrete placed in each independent structure.
- If the quantity of concrete from which samples were taken is less than 40 m³, it shall be subject to the testing of a minimum of 2 sets of samples per day from each grade of concrete placed in each independent structure.

Cost of tests

The costs of making, storing and testing of concrete test cubes as required under clause 7 'Tests' of SANS 1200 G shall include the cost of providing cube molds necessary for the purpose, for testing costs and for submitting reports on the tests to the Project Manager. The testing shall be undertaken by an independent firm or institution nominated by the Contractor to the approval of the Project Manager (Test cubes are measured separately)

If the quantity of concrete from which samples were taken exceeds 40 m³, it shall be subject to the testing of a minimum of 3 sets of samples per day from each grade of concrete placed in each independent structure.

If the quantity of concrete from which samples were taken is less than 40 m³, it shall be subject to the testing of a minimum of 2 sets of samples per day from each grade of concrete placed in each independent structure.

If the Contractor disputes the results of the tests on concrete cubes, the concrete represented by the cubes will be considered acceptable if the Contractor, at his own cost, proves to the satisfaction of the Project Manager that the estimated actual strength of cores taken from the structure, determined in accordance with SANS Standard Method SM 856, is not less than the specified strength.

If the strength of the concrete fails to meet the acceptance criteria stipulated, the Project Manager may in his sole discretion and in addition to the options listed in SANS 1200 G:

- Accept the concrete subject to approved remedial measures being undertaken by the Contractor; or
- Permit the concrete to remain subject to the payment of a penalty.

The penalty referred to will be determined as follows:

$$\text{Penalty} = V \times R \times F$$

Where?

V = Volume (in the opinion of the Project Manager) of concrete of unsatisfactory strength represented by the test result.

R = Relevant scheduled rate

$$F = 1 - \sqrt{\frac{\text{Average strength of unsatisfactory concrete}}{\text{Specified strength} + 6 \text{ MPa}}}$$

Where the relevant scheduled rate (R) includes the cost of formwork or

$$F = 1 - \frac{\text{Average strength of unsatisfactory concrete}}{\text{Specified strength} + 6 \text{ MPa}}$$

Where the relevant scheduled rate (R) excludes the cost of formwork or where no formwork was involved.

1.1. Formwork

Descriptions of formwork shall be deemed to include use and waste only (except were described as left in or permanent), for fitting together in the required forms, wedging, plumbing and fixing to true angles and surfaces as necessary to ensure easy release during stripping and for reconditioning as necessary before re-use.

Formwork to sides of bases, pile caps, ground beams, etc. have been measured provisionally and will only be paid for where it is specifically prescribed by the Technical Officer for design reasons. Formwork necessitated by irregularity or collapse of excavated faces will not be measured and the cost thereof shall be deemed to be included in the allowance for taking the risk of collapse of the sides of the excavations, provision for which is made in Earthworks.

Formwork

All exposed concrete corners shall be provided with 20mm x 20mm chamfers.

Rough formwork (degree of accuracy ii)

Rough Formwork to Sides:

Strip footings.

Bases.

Walls in foundations.

Outer face of walls flushes with perimeter of concrete structure.

Rectangular columns in foundations.

Edges not exceeding 300mm high.

Rough Formwork to Circular Columns

Smooth formwork (degree of accuracy ii)

Smooth Formwork to sides:

Inner face of shaft walls.

Edges not exceeding 300mm high.

Movement joints etc.

Expansion joints with soft board between vertical concrete surfaces:

12mm Joints not exceeding 300mm high.

Saw cut joints:

3.2 x 50mm and 6.4 x 20mm saw cut joints in two operations in top of concrete.

Seal with Sikaflex-11FC, or similar approved, on backing chord. Installation to manufacturer's specification

Horizontal toggle construction joints through concrete including thick cement slurry to one face.

Reinforcement

High tensile steel reinforcement to structural concrete work:

In various diameters and lengths

Mild steel reinforcement to structural concrete work

In various diameters and lengths

High tensile steel reinforcement to structural concrete work

Fabric reinforcement:

Fabric reinforcement type as specified on structural drawings.

Sleeve Pieces and Ties

Where it is necessary to leave plugs or holes in beams, slabs or any other reinforced concrete, all such plugs or holes must be situated in positions approved by the Supervisor before concreting. Where it is necessary to carry pipes, bolts, wires or any other fittings through reinforced concrete members, approved pipe sleeves must be provided and placed in position before concreting.

Where waste, ventilation water, heating or other pipes under 100mm diameter pass through concrete slabs and beams, galvanized mild steel sleeve pieces or diameters shown or required shall be cast into such concrete slabs and beams.

Chases shall be formed in edges of slabs or slots shall be formed in the slabs, or sizes required, where two or more pipes pass through together.

All necessary bolts, plugs, brackets, cramps, etc. shall be cast into the concrete as the work proceeds.

Where brickwork abuts against concrete, the brickwork is to be tied to the concrete with galvanized hoop-iron ties 1.6m thick by 32mm wide and approximately 600mm long to every third course of brickwork with one end of each tie cast approximately 150mm deep into the concrete. Where such fixing is impossible, i.e. where steel formwork is used, the ties are to be gun-nailed against concrete with steel nails to less than 38mm long.

Forming key to concrete for plaster, mosaic tiles and other finishes

Where rough formwork has been used, surfaces of concrete to receive plaster, mosaic tiles and other finishes, shall, immediately after the formwork has been removed, be well wetted and wire brushed whilst the concrete is still green and then shushed over with 2:1 cement grout to form a key for the finish, all to the approval of the Supervisor. The shushing is to be allowed to set hard before the finish is applied.

Where smooth formwork is used, surfaces of the concrete to receive plaster, mosaic tiles and other finishes shall be hacked, on the distinct understanding that hacking of concrete shall be at no extra cost to the employer.

Surfaces of concrete receiving plaster or other finishes shall not be plastered or finished until the Supervisor has signified his opinion in writing that the surfaces are suitable to receive plaster or other finishes.

Where brickwork abuts against concrete, the brickwork is to be tied to the concrete with galvanized hoop-iron ties 1.6mm thick by 32mm wide and approximately 600mm long to every third course of brickwork with one end of each tie cast approximately 150mm deep into the concrete. Where such fixing is impossible, i.e. where steel formwork is used, the ties are to be gun-nailed against concrete with steel nails to less than 38mm long.

Bagged Finish to Concrete

Concrete surfaces to receive bagged finish shall be prepared by removing sharp projections and making good defects with 3:1 cement mortar. Finish by rubbing over the whole area with wet rough sacking and cement grout to obtain an even surface.

Power Floated Finish

Power floated finish to floors etc. means that surfaces shall be floated c/mechanically to a smooth and even finish before the concrete has set. Small areas inaccessible to the machine are to be floated by hand. Under no circumstances is cement mortar to be added while floating the concrete.

“No Fines” Concrete

“No-fines” concrete, for grading flat concrete roofs and the like to falls, shall be in the proportion of 12 parts 19 iron cubical stone to 1 part cement mixed with 20 liters water per bag of cement and be

laid to falls of not less than 15mm per linear meter for mastic asphalt and not less than 20mm per linear meter for sheet roof covering. For heavy load applications special mix designs may be required.

(a) Fillets against up stands:

Form triangular fillets, size 100 x 100mm, in corners with walls, kerbs, etc. neatly mitred at angles, stopped where necessary and finished smooth ready to receive waterproofing.

(b) To raised floor, bases, etc.:

No-fines" concrete for raised floors, bases, etc. shall be in the proportions specified. Finished smooth with 3:1 sand/ cement screed to receive waterproofing.

Precast Concrete

Materials

Cement, water, aggregates and reinforcement shall be as described under: CONCRETE, FORMWORK AND REINFORCEMENT.

Concrete

Concrete shall be as described under: CONCRETE, FORMWORK AND REINFORCEMENT and, unless otherwise specified. Class E concrete shall be used but with coarse aggregate of an appropriate size.

Smooth Finish

Where described as "finished smooth from the mould" such surfaces shall have a layer of fine stuff composed of 1:4 (1 part cement and 4 parts clean fine sand by volume) packed against the faces of the mould before placing the concrete backing. The concrete backing shall be disposed into the moulds in a wet state (not dry pressed) while the facing is still wet.

Projections shall be rubbed off the faces shall be of even colour and free from blemishes, cracks and other imperfections. Salient angles shall be arras rounded.

4.5 Steel Work

4.5.1 Governing Codes and Standards

SANS Specifications	
SANS 10094	The use of high strength friction grip bolts and nuts
SANS 135	ISO metric bolts, screws and nuts (hexagon and square) (coarse thread free fit series)
SANS 136	ISO metric precision hexagon-head bolts and screws, and hexagon nuts (coarse thread medium fit series)
SANS 435	Mild steel rivet

BS Specifications	
BS-EN 287 Part 1	Approval testing of welders/fusion welding
BS-EN 288 Part 3	Specification and approval of welding procedures for metallic materials
BS 5135	Metal arc welding of carbon and carbon manganese steels
BS 4360/SANS 50025	Weldable structural steel
BS 2573 Part 1	Classification, stress calculations and design of structures
BS 3923	Methods for ultrasonic examination of welds
BS 2600	Radiographic examination of fusion welded butt joints in steel

Other Specifications	
ANSI/AWS D1.1	Structural Welding Code - Steel
DIN 1026	Metric channels
ISO R657	Angles

4.5.2 Structural Steelwork

The design of all structural steelwork shall be such as to provide a robust and rigid structure requiring the minimum of maintenance and providing a long service life.

In the design of steel structures, due cognizance shall be taken of environmental and wind load conditions as specified in the main specification.

Due to the highly corrosive conditions experienced in South African Ports, the permissible stresses shall not exceed those set out in British Standard No. 2573. The minimum thickness of steel for load bearing members shall be 15mm for gussets, 10mm for angles, tees, plates and flats and 9mm for webs of channels and joists. Punching of holes over and above that permitted in BS 2573, shall not be permitted. Other structural steel shall be of not less than 6 mm thickness.

The design of mobile structures shall be such that the induced von Mises stress (effective stress in triaxial loading) will not exceed 90% of the elastic limit strength of the steel when the equipment is travelling at maximum speed and colliding with either other stationary equipment or fixed stop blocks. In calculating von Mises stresses, due cognizance must be taken of stress concentrations. If the elastic limit strength of the steel is not known, it will be determined by using a 0.5% strain offset on the stress-strain curve of the material.

Where applicable, the design may be in bolted, riveted or welded box construction except that no site welding will be permitted in the final erection at the port except with the approval of TNPA.

Alternatively, a welded hollow section lattice type structure will be acceptable, subject to the following requirements:

- The members must be structural sections made from BS 4360/SANS 50025 grade S355JR / 43C weldable structural steel - welded for sizes up to and including 110mm outside diameter (BS 1775 HFW) - seamless for sizes over 110mm outside diameter (BS 1775 HFS).
- Tube wall thickness must not be less than 6mm.
- All joints must be completely seal welded in accordance with BS 5135. Special care must be taken to prevent the ingress of moisture into hollow section members by ensuring that each member is airtight.
- Bolted or screwed attachments which require drilled holes through a hollow section will not be permitted.
- Non-hollow structural sections and plate used on the structure, in conjunction with the hollow section framework, must comply with the relevant requirements of this specification.

All steel sections shall be manufactured in accordance with the following standards: -

Weldable structural steel	:	BS 4360/SANS 50025
I and H sections	:	BS 4 Part 1
Metric channels	:	DIN 1026
Structural steel, hot rolled sections	:	BS 4 Part 1
Angles	:	ISO - R657

Hot finished hollow sections	:	BS 4848 Part 2
Cold formed sections	:	BS 6363
Forgings	:	BS 29
Steel castings	:	BS 3100
Cast iron	:	BS 1452

All steel plates and rolled steel sections used in the construction of the structures shall be of steel made by the open-hearth process (acid or basic) and shall comply in every respect with BS 4360, "A" quality Structural Steel for Bridges and General Building Construction, Grade 43A or Grade 50B or SANS 50025 grade S355JR, where sections sizes allow. That is, the percentage of phosphorous and Sulphur shall not exceed 0,06.

The above is laid down as a standard, but tenders will also be considered for rolled steel not conforming strictly to the above standard. Full particulars of the guaranteed properties of the steel tendered for should in this case be furnished, i.e. chemical composition, tensile strength, yield point, reduction in area, bend tests, etc.

Forgings and drop forgings shall be free from flaws and surface defects of any kind and be accurately finished to the prescribed dimensions.

Steel castings shall be sound, clean and free from all defects and distortion of any kind and should, except where otherwise specified, conform with the conditions and tests specified in B.S. No. 3100/Latest Edition, for grades A, B and C according to requirements. They shall be thoroughly annealed and all working parts and bearing surfaces shall be machined and turned accurately with correct finish.

Cast iron used throughout must be close grained, tough and free from all defects, and shall conform to the conditions and tests specified in B.S. 1452/Latest Edition, for grades 12 to 14 according to requirements.

This applies to functional components only. A lower grade is acceptable for portal and machinery house ballast. Tenderers to state grade of cast iron proposed.

The dimensional and out-of-square tolerance as specified in the above Standards shall also apply to built-up components. Edge preparations, welding techniques, straight beds and material fit-up shall be considered when welded joints are designed.

The shape of all members and connections must allow easy accessibility for maintenance painting of all surfaces. No members shall comprise a double member which cannot be painted and maintained.

Structural details must be so designed as to eliminate or seal off any cavities or pockets where water or condensation could collect and promote corrosion. Horizontal members with upstanding flanges require special drainage.

All hollow sections shall be completely closed and airtight, and all welding is to be of such size and quality as to ensure complete airtightness. No tapping or drilling of holes into sealed sections will be permitted.

4.5.3 Welding

All the provisions of BS 5135 shall be complied with as far as applicable.

Design of weld joints shall be such that crevices, overlaps, pockets, arc strikes, and dead ends do not exist.

All joints shall be completely seal welded in accordance with BS 5135. Special care must be taken to prevent the ingress of moisture into the tubular members by ensuring that each such tubular member is airtight. "Stitch" welding will not be permitted. Only continuous welding will be accepted.

Weld cracks, undercut, or pock marks will not be accepted.

All welds on the load bearing frame structure, containers, piping, pipeline flanges, etc., shall be continuous and shall be visually inspected for cracks and other discontinuities.

Welds on the main chords must be tested ultrasonically in accordance with BS 3923 or x-rayed in accordance with BS 2600 and those on minor joints by the dye-penetrant method. The equipment required for these tests must be supplied by the Contractor and the testing done at his cost.

Steel, except in minor details, which has been partially heated, shall be properly annealed. (Electrically welded structural members accepted.)

All brackets, clamps, lugs, straps, suspenders, etc. required for attaching mechanical and electrical equipment must be welded on prior to erection and special precautions must be taken not to damage welds or puncture tubes during erection.

The welding of all rails shall be done by an approved method.

Welding shall only be carried out by a coded welder according to SANS 10044, BS-EN 287 Part 1 and BS-EN 288 Part 3 or ANSI/AWS D1.1.

All parts to be welded shall be thoroughly cleaned and dried before welding. The welding will only be done in dry surroundings and all steps taken to prevent hydrogen embrittlement.

Where materials of different compositions are joined by welding, especially carbon steel to chrome steel, the filler welding method and post welding treatment shall be such that embrittlement and other degradation of both steel and filler is prevented.

It must be ensured that welded joints are ductile.

4.5.4 Fasteners

All bolts, nuts and rivets shall be manufactured in accordance with the following standards: -

Commercial bolts and nuts Grade 4.6 : SANS 135

Precision bolts and nuts Grade 8.8 : SANS 136

Friction Grip Bolts and nuts Grade General : SANS 10094

Rivets : SANS 435

All friction grip fasteners shall be hot dip galvanized, including high tensile bolts (and their nuts and washers), structural rivets and Huck bolts.

All holding down bolts and nuts and brackets, as well as all fixing bolts, studs, nuts and washers shall be of stainless steel. Fixing rivets shall be of either stainless steel or brass.

Bolts and set screws shall be locked in an approved manner and shall not be stressed in tightening to beyond the recommended loads.

The quality of friction grip bolts, nuts and washers, bolt lengths, sizes of holes, tightening standards, surface condition of clamped components, shop and site assembling, and acceptance inspection of friction grip joints shall comply with the latest edition of SANS 10094. Certificates shall be supplied for all bolts of grade 8.8 and 10.9.

All bolt and rivet holes must be accurate to size and location, the centres of holes shall not be placed nearer the edge of a plate than 1,5 diameters with an extra allowance of 3mm for sheared edges. All holes in the structural work shall be drilled or otherwise punched to a diameter not exceeding 1,5mm less than the diameter of the finished hole on the die side, and afterward reamed out to the exact size.

Where possible the adjoining parts forming a connection shall be drilled or reamed together, with holes not exceeding 1,5 mm diameter the rivet or bolt for which it is made. No rough or broken edge shall be left around any of the holes.

For turned and fitted bolts, the holes shall be accurately drilled or reamed; the diameter of the hole shall not exceed the finished diameter of the bolt by more than 0,25mm.

The holes, after assembly of the parts, shall be true throughout the thickness of all the parts and perpendicular to the axis of the member.

Rivets shall be cup-headed or countersunk as required, unless otherwise specified. No rivet head shall contain less metal than does a length of the rivet equal to 1,25 times its diameter. All loose and defective rivets shall be cut and replaced by sound ones; also, others when required for the purpose of examining the work. Rivets shall be driven with pressure tools whenever possible and pneumatic hammers shall be used in preference to hand driving.

All field rivets must be supplied with shanks of suitable length for pneumatic riveting.

Bolts shall be of such a length as to accommodate a full nut when tightening up, and project at least two thread pitches beyond the nut. Excessive projection of threads beyond the nuts should be avoided.

All bolts having countersunk heads shall have strong feathers forged on the neck and head to prevent turning and the bolt holes shall be cut to receive same. All nuts and bolts (excluding countersunk bolts) shall be furnished with circular washers of sufficient thickness, the outside diameter being at least twice the nominal diameter of the bolt, and washers fitted correctly.

Where bolt heads or nuts are seated on beveled surfaces of beams or channel flanges, beveled washers must be inserted.

4.5.5 Joints and Mating Surfaces of Members

Mating surfaces of members to be joined by high tensile steel bolts in friction grip shall be cleaned and primed as specified for the rest of the steelwork. Mating surfaces shall lay flat against each other to eliminate gaps which may allow ingress of water. After joining, the edges shall be sealed with an approved brand of Butyl/ Rubber sealing compound by means of a suitable caulking gun or shall be seal welded.

Other joints shall be formed by one of the following methods:

The mating surfaces of members shall be blast cleaned, primed and protected prior to sub-assembly by the liberal application of caulking compound. While the compound is still wet, the members shall be bolted together and caulking compound which is squeezed out shall be completely removed.

The mating surfaces shall be protected with the full corrosion protection system as specified, the surfaces joined together and the joint so formed shall be sealed with butyl rubber sealer.

After being cleaned and primed the surface shall be joined together and the joint so formed shall be seal welded.

The primer coating on mating surfaces must be applied not more than 4 hours after cleaning and the edges must be sealed within 3 weeks of assembly of the part.

4.5.6 Fabricated Parts

All fabricated parts shall be properly fitted during assembly to result in properly aligned equipment having a neat appearance. Fabrications of load bearing members shall have no abrupt changes in cross section and regions of severe stress concentration. All sharp corners accessible by personnel during erection or operation shall be ground, rounded, or removed by other methods. Burrs, welding spatter and stubs of welding wire shall be removed.

4.5.7 Ballast or Counter Mass

Tenderers must include for the supply of all necessary ballast or counter mass.

These must preferably be of cast iron and be removable for maintenance of structural steelwork.

Concrete ballast is not recommended but will be accepted provided the Tenderer satisfies Transnet that it will not cause corrosion of any steel parts.

Fastenings used for removable pieces must be of non-corrosive material.

Ballast must be in suitable shapes to be secured in position against movement but in sizes easily removable for maintenance.

Lifting hooks or eyes of non-corrosive material and of adequate strength must be provided in the removable ballast pieces.

Concrete ballast must be reinforced so as to prevent cracking or breaking and must be coated with an approved corrosion protection system for concrete.

4.5.8 CORROSION PROTECTION (SPECIFICATION HE9/2/8 - [Version 16] - July 2002)

a) Scope

Structural steelwork in coastal area (within 10km from coast):

Structural steelwork is to be protected against corrosion as follows:

This specification covers requirements for protective coating of iron and steel structures, electrical motors, gear boxes etc. against corrosion and must be read in conjunction with the main specification as well as the following (latest editions): -

- SANS 10064 "Preparation of steel surfaces for coating"
- SABS 121 "Hot-dip (galvanized) zinc coatings"
- SANS 1091 "National colour standards for paint"
- BS 5493 "Code of practice for protective coating of iron and steel structures against corrosion"

b) Types of Corrosion Protection to BE USED

- The coatings specified in this specification are chosen according to BS 5439, Table 3, part 9, to ensure that the condition of the surface will be at least RE2 on the European scale of degree of rust, after 10 years in an environment of frequent salt spray, chemicals and polluted coastal atmosphere. During the 10 years, the normal maintenance painting will be done.
- The paint manufacturer shall guarantee the paint for at least 10 years.
- Should a tenderer wish to offer coating systems other than those specified, as an alternative, he shall submit full technical details and a list comparing all appropriate details of the alternatives proposed, with the original specified.
- Tenderers must ensure that the different coats they offer in their tenders are compatible with each other.
- The coating of proprietary items must be done according to Clause 3.
- All galvanized components including bolts and nuts but excluding walkway gratings, must be painted with the specified system, unless otherwise approved.
- The following coating systems must be used unless otherwise specified in the main specification: -

Substrate	Coat No	Generic Description	Approved Brand Products	Dry Film Thickness (µm)
3CR12 steel	1	Surface tolerant epoxy primer	DULUX /SIGMA Sigmacover primer	65-75

			INTERNATIONAL (PLASCON) Intergard 269 STONCOR (CHEMRITE COATINGS) Carboline 193 Primer	
	2	Two component recoatable, polyurethane finish (Gloss)	DULUX / SIGMA Sigmadur gloss INTERNATIONAL (PLASCON) Interthane 990 STONCOR (CHEMRITE COATINGS) Carboline 134	65-75
Galvanized Steel	1	Surface tolerant epoxy primer	DULUX /SIGMA- Sigmacover primer INTERNATIONAL (PLASCON) Intergard 269 STONCOR (CHEMRITE COATINGS) Carboline 193 Primer	65-75
	2	Two component recoatable, polyurethane finish (Gloss)	DULUX /SIGMA- Sigmadur gloss INTERNATIONAL (PLASCON) Interthane 990 STONCOR (CHEMRITE COATINGS) Carboline 134	65-75
Mild steel	1	Two component self-curing inorganic zinc ethyl silicate OR two component zinc rich polyamide	♦ DULUX /SIGMA- Sigma MC60 OR Sigma-cover primer INTERNATIONAL (PLASCON) Interzinc 233 OR Interzinc 52 or 53 STONCOR	65-75

		cured epoxy primer	(CHEMRITE COATINGS) Carbo Zinc 11 OR Carbo-line 658 Primer	
	2	Flexible recoatable high build polyamide cured MIO epoxy.	DULUX/SIGMA – Sigmacover CM MIO INTERNATIONAL (PLASCON) Interseal 010 MIO STONCOR (CHEMRITE COATINGS) Carboline 190 HB M.I.O. or Carboline 193 M.I.O.	125-150
	3	Two component recoatable, polyurethane finish (Gloss)	DULUX/SIGMA Sigmadur gloss INTERNATIONAL (PLASCON) Interthane 990 STONCOR (CHEMRITE COATINGS) Carboline 134	65-75

- The paint manufacturer's recommendations for the application of the different coating systems, curing time before handling or application of subsequent coats, health and safety recommendations etc. must be carefully adhered to.
- Paint contractors must have a quality management system which must be submitted to the Engineer for approval before commencement of the work.
- Galvanizing shall be done to SANS 121 heavy duty hot dip galvanizing to a thickness of at least 85µm. Electroplated components in zinc or cadmium are not acceptable.
- All mounting bolts, nuts, washers and brackets as well as all fixing bolts, studs nuts and washers shall be of stainless steel. Fixing rivets shall be of either stainless steel or brass.
- High tensile bolts for friction grip joints must be hot dip galvanized and painted. High tensile bolts must be certificated after galvanizing.
- The full paint system shall be applied to all surfaces which are to be covered with wear pads, linings etc.
- For steelwork which will be transported over long distances and erected on site the two pack epoxy primers are preferred.

c) Surface Preparation

- All steel surfaces shall be detergent washed and fresh water rinsed to remove all oil, grease and surface contaminants before shot blasting.

- Sharp edges shall be radiused and major roughness of welds shall be removed by grinding. Welding spatter and flux shall be removed.
- Components manufactured from hot rolled steel sections and steel plate shall be blast cleaned to base metal in accordance with SANS 10064 grade SA2½ - very thorough blast cleaning, to remove all mill scale, rust, weld spatter etc.
- "Sharp" chilled iron shot, chilled iron grit, or granular abrasive slag is to be used to produce a proper degree of surface roughness.
- Blast profile shall be determined by micrometer profile gauge, Keane-Tator surface profile comparator or Testex press-o-film.
- The profile height shall be between 40 and 50µm at any point.
- Good quality blast cleaning and spray-painting equipment shall be used. Air used for spraying and blast cleaning shall be free from all traces of oil, water and salinity. Water and oil traps must be fitted to all equipment.
- Wheel abrading equipment shall not be used unless an angular profile the same as clause 4.3.3 is achieved.
- When wet blasting is done the primer shall be applied before oxidization starts or surface contamination occurs.
- Components manufactured from 3CR12 steel shall be lightly abraded. The components shall then be passivized by using a mixture of 10 - 15% nitric acid in water which is rinsed off after 10 - 15 minutes. The surface shall be neutralized to pH 7 before it is coated.
- Hot-dip galvanized components, galvanized bolts and nuts etc. shall be lightly abraded with a galvanizing pre-cleaner. The components shall then be washed with detergent and water and washed down with clean water until a water break free surface is achieved. Allow to dry thoroughly.

d) Joints and Mating Surfaces of Members

- Mating (faying) surfaces of members which have to be joined by high tensile steel bolts in friction grip shall be cleaned according to Clause 4 and painted with primer only.
 - After being assembled joints so formed shall be seal welded and painted or after the intermediate coat was applied the edges shall be sealed with an approved brand of paintable flexible sealant or mastic (e.g. Butyl rubber, polyurethane sealer or two component epoxy), by means of a suitable caulking gun.
 - All rivets, bolts, welds, sharp edges etc. must be covered with a "stripe coat" of the primer or intermediate coat specified to ensure the correct dry film thickness on sharp edges, as well as sealing of bolt threads to head etc.
 - All other mating surfaces must be sealed with an approved brand of flexible Butyl rubber, paintable Silicone, polyurethane sealer or two component epoxy sealer, and joined while still wet. All excess compounds must be completely removed.

e) Painting Procedures

- Directly before the application of paint, the area to be painted shall be degreased with a

suitable degreaser and left to dry.

- Paint shall only be applied under the following conditions: -
- There is adequate light.
- The steel temperature is between 5 and 50°C and at least 3°C above the dew point of the air.
- The relative humidity of the air is between the limits specified by the paint supplier.
- Wind does not interfere with the method used and sand and dust cannot be blown onto wet paint.
- Steelwork shall be supported on trestles, at least 900 mm off the ground for painting purposes.
- An adequate number of test readings shall be taken per square meter in order to determine the dry film thickness.
- The paintwork shall be acceptable if the average of the test readings taken falls within or exceeds the ranges given.
- Paintwork shall not be acceptable if any single test reading is less than the specified minimum thickness.
- An ultrasonic or electronic magnetic flux thickness measurement gauge shall be used, but in case of dispute, destructive testing shall be applied. The painted steelwork shall present a clean, neat appearance of uniform colour and gloss as applicable to the paint used. Each coat of paint shall be applied as a continuous, even film of uniform thickness. More than one application of paint may be required to achieve the dry film thicknesses specified or to obliterate the colour of the previous coating.
- The use of thinners or solvents at any stage of the work is prohibited, unless specified by the paint manufacturer.
- Precautions shall be taken to prevent coatings from being applied to equipment nameplates, instrument glasses, signs etc.

f) **Colour Codes**

Equipment shall be painted in the following final colours: -

Area	Colour	Code No. [SABS 1091 and International No's]
a) Hand levers, hand wheels, oiling points, handrails on walkways, ladders	Golden Yellow (High Gloss)	SABS 1091 B49 BS 381C-356
b) Informatory signs and notices (not symbolic safety signs for which see SABS 1186)	White on Emerald Green (High Gloss)	White on SABS 1091 E14 BS 381C- 228

Area	Colour	Code No. [SABS 1091 and International No's]
Pipelines		
a) Reclaim water piping	Aluminum	
a) Slurry pipelines	Dark admiralty grey	SABS 1091-G12
b) Fire protection piping	Signal red	SABS 1091-A11
c) Wash water drainpipes	Light grey	SABS 1091-G29
d) Instrument air	White with Strong blue band	White and SABS 1091-F11
e) Plant air	White with Flag blue band	White and SABS 1091-FO4
f) Potable water	Grass green	SABS 1091-D14

Colour bands for pipes shall be 75 mm wide for pipe sizes up to 150 mm diameter and 100 mm wide for 150 mm and above. The colour bands shall be applied to the pipe flanges, valves, junctions, walls or structures etc. in such a manner that the pipe may be easily identifiable. On straight sections the maximum spacing shall be 100 x the pipe diameter.

g) Field Touch-up Painting

- Damaged and unpainted areas, fasteners, welds, etc. shall be cleaned by wire brushing with hand tool or power tool in a manner which will minimize damage to sound paint. Grinding will not be allowed. Rust spots shall be cleaned to bright metal. Thick edges of old paint abutting on bare metal surfaces shall be feathered by scraping and sanding.
- Where welding is required on areas already coated with the coating system, the coat should be stepped back for $\pm 30\text{mm}$ around the weld area.
- The paint shall be applied to match the original coats in accordance with the manufacturer's recommendations for the specific paint system.
- Note: Inorganic zinc primers shall not be re-covered with an inorganic primer, but only with an organic zinc primer.
- Areas of damaged galvanizing shall be repaired with an approved cold galvanizing product or metal sprayed by the wire spraying process with Zinc, and then touched up with the specific paint system.

h) General

- All walkways, floors, maintenance platforms etc. must be painted with a durable, nonskid coating of the appropriate colour.
- Expose machined surfaces must be coated with a strippable corrosion inhibitor (e.g. Tectyl).
- Where different materials will be in contact with each other, and galvanic corrosion can occur the contact areas of the materials must be isolated from each other, or the joints made waterproof to prevent ingress of moisture.

i) Maintenance Painting of Structures

Areas which are only lightly corroded must be cleaned by means of high-pressure water blasting or wire brushing by power tool and the following system applied: -

Coat No	Generic Description	Approved Brand Products	Dry Film Thickness (µm)
1	Surface tolerant two pack epoxy primer with aluminum pigments	Dulux/SIGMA Aluprimer STONCOR (CHEMRITE COATINGS) Carbomastic 15 INTERNATIONAL (PLASCON) Intergard 468	125-150
2	Same as first coat OR micaceous iron oxide (MIO) epoxy	DULUX/SIGMA – Sigmacover CM MIO INTERNATIONAL (PLASCON) Interseal 010 MIO STONCOR (CHEMRITE COATINGS) Carboline 190 HB M.I.O. or Carboline 193 M.I.O.	125-150
3	Two component recoatable, polyurethane finish (Gloss)	DULUX/SIGMA Sigmadur gloss INTERNATIONAL (PLASCON) Interthane 990 STONCOR (CHEMRITE COATINGS)	65-75

		Carboline 134	
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- Alternatively, the Noxyde paint system can be used, consisting of two to three coats of water based Noxyde paint to achieve a DFT of 350 to 400 microns. Where the Noxyde system is used on areas other than slightly corroded structural areas, the following additional requirements must be observed:
 - Very smooth surfaces (e.g. 3CR12, stainless steel or hot-dip galvanized components, bolts, nuts and fittings, and HT bolts): Parts must be thoroughly degreased using OptiDegreaser, washed down with potable water, and immediately when dry, a single coat of OptiPrimeAqua applied.
 - Paintable flexible sealant/mastic: Only sealant approved by the paint manufacturer may be used, and an initial coat of OptiPrimeAqua applied over it before the further coats of Noxyde are applied.
 - Bolted/riveted connections: After blasting or and/or cleaning as required, apply a coat of OptiPrimeAqua and an additional stripe coat of Noxyde, in contrasting colour, to all bolt/nut and plate edges and crevices.
- The adhesion of old coatings must be verified by doing a crosscut adhesion test on selected areas.
- The compatibility of the new paint system on the old coating must be tested and guaranteed in writing by the paint supplier.
- The work and coating system must be guaranteed for a minimum of 12 months.
- All heavily corroded areas must be shot blasted to minimum SA2, and the three-coat system indicated in clause 2.6 applied.
- Areas where the old coating is still sound need only be high pressure cleaned with a suitable solvent and coated with one of the primers suggested in clause 10.2 (as tie coat) and then with one of the topcoats suggested in clause 2.6 to get the appropriate colour and finish. The minimum dry film thickness of this tie coat must be 75 microns and topcoat must be 50 microns, but the previous coating colour shall be completely obliterated to present a uniform colour.
- Note: Inorganic zinc primers shall not be re-covered with an inorganic primer, but only with an organic zinc primer.
- Repairs to the insides of all the enclosed sections of the booms as well as the insides of the crane legs, sill beams, cross beams, pylon cross bracing members etc. shall be done as above but the topcoat need not be applied.

5 Management and start-up

5.1 Management Meetings

Regular meetings of a general nature may be convened and chaired by the Project Manager as follows:

Table 4

Title and purpose	Approximate time & interval	Location	Attendance by:
Project Progress Meetings (Report on the progress)	Bi-weekly (once every fortnight)	Transnet Port Terminal-Saldanha	Project Manager, <i>Contractor's</i> representatives and other appropriate individuals as required by the <i>Project Manager</i> .
Safety Action Meetings (Discuss urgent safety issues within the project)	On urgent basis as requested by the <i>Project Manager</i> to address particular issues.	Transnet Port Terminal-Saldanha	<i>Project Manager,</i> <i>Contractor's</i> representatives and other appropriate individuals as required by the <i>Project Manager</i> .
Risk Assessment Meetings (Discuss risk issues within the project.	On urgent basis as requested by the <i>Project Manager</i> to address particular issues.	Transnet Port Terminal-Saldanha	<i>Project Manager,</i> <i>Contractor's</i> representatives and other appropriate individuals as required by the <i>Project Manager</i> .

- It is the *Employer's* specific intention that the Parties and their agents use the techniques of partnering to manage the contract by holding meetings designed to pro-actively and jointly manage the administration of the contract with the objective of minimising the adverse effects of risks and surprises for both Parties.
- The *Contractor* attends management meetings at the *Project Manager's* request. These meetings are to be held fortnightly or as regularly as may be determined by the *Project Manager*. At these meetings the *Contractor* presents all relevant data including safety, health and environmental issues, progress, quality plans, Sub-Contractor management, as may be required.
- Meetings of a specialist nature may be convened as specified elsewhere in this Works

Information, or if not so specified, be convened by persons at times and locations to suit the Parties, the nature and the progress of the Works. Within five days of the meeting the person convening the meeting shall submit records of the meeting to the *Project Manager*.

- All meetings shall be recorded, preparing meeting minutes and circulated by the person who convened the meeting. Such minutes (or register) shall not be used for the purpose of confirming actions or instructions under the contract as these shall be done separately by the person identified in the conditions of contract to carry out such actions or instructions.

5.1.1 Documentation Control

- Transnet uses a document controlling system to track, record and control documentation circulated.
- All formal communication should be submitted to TPT Document Controller.
- This include among others, circulation of minutes, drawings, claims etc.
- TPT Document Controller shall work with the *Contractor's* Document Controller (if available).

5.1.2 Safety Risk Management

- The *Contractor* must submit a safety file to TPT SHEQ department for approval after appointment.
- The *Contractor* may not commence with Work onsite unless the safety file has been approved by TPT SHEQ.
- The *Contractor* shall submit a Method Statement to TPT for approval with all the necessary holding points.
- The *Contractor* shall compile a risk assessment before executing any task. The assessment must be shared with the *Project Manager's* assigned person onsite who is monitoring the construction activities.

5.1.3 Environmental Constraints and Management

The *Contractor* shall ensure that the execution of the Works complies with all the environmental standards and regulations. The TPT SHEQ Manager shall work closely with the project team and the *Contractor* to ensure that all environmental standards and regulations are well understood by everybody.

5.1.4 Quality Assurance Requirements

- The *Contractor* shall not undertake any work in advance before review and acceptance of the Quality Control Plan and/or without the written consent of Transnet.
- Pre-inspection meetings may be held at the discretion of Transnet. In such cases, the content of the agenda shall include, but not be limited to, the following:
 - Documentation: Method of Submission reviews etc.
 - Quality Control Plan: Agreement of inspection, witness, review and hold points,

Agreement of contacts for notification, etc.

- Code Data book / QC Dossier: Agreement to contents and format.
- QC Procedures: Agreement to Scope.
- AIA: Authorised Inspection Authority requirements.
- Communications: Responsible persons.
- Non-destructive Testing: Personnel qualification, method and extend required.

Definition: Inspection means all activities such as measuring, examining, testing, gauging one or more characteristics of material or service and comparing these with specified requirements to determine conformity.

The *Contractor* shall as a minimum, carry out the inspections as detailed in the Quality Control Plan and maintain the required records for verification by Transnet Project Manager or delegated Transnet *representing* the *Employer*. Signing-off of the Quality Control Plan progressively by all relevant parties is a mandatory requirement following the indicated inspection activity.

Non-Conformities: Non-Conformity is defined as a deficiency in characteristic, documentation or procedure which renders the quality of an item, work or service unacceptable or indeterminate in accordance with specified requirements. Such Non-Conformities shall be identified by the *Contractor / Project Manager*.

All proposed re-working or repair shall, together with the relevant procedures, shall be firstly reviewed by the *Project Manager* or any other assigned *Employer's* representative.

The *Contractor* shall maintain a register of his NCR's and shall submit this register to the *Employer* monthly. The *Employer* reserves the right to request copies of NCR's for review of deviation and disposition.

The *Contractor* develops and maintains a comprehensive register of documents that will be generated throughout the contract including all quality related documents as part of its Quality Plan.

The *Project Manager* will indicate those documents required to be submitted for either information, review or acceptance and the *Contractor* will indicate such requirements within his register of documents.

The Quality Plan means the *Contractor's* statement, which outlines strategy, methodology, resources allocation, QA and Quality Control co-ordination activities to ensure that the *Works* meet the standards stated in the Works Information.

5.1.5 Programming Constraints

The indicative timelines for the project are as follows:

- The *Contractor* and the *Employer* shall agree on the programme for the execution of the project. The *Project Manager* shall compile a programme and present to the *Contractor*. In

relation to the programme drawn by the *Project Manager*, the *Contractor* should provide a programme and use standard NEC Scope Document programme clauses in the template.

- The *Contractor's* Programs is evaluated by the *Project Manager* to assess the *Contractor's* ability to plan his portion of the project to the extent necessary for the high degree of mutual co-ordination demanded by the Project.
- The *Contractor* submits a program within 1 weeks of the date on which he was notified of having been awarded the contract / order.
- The *Contractor* shows on his Accepted Programme and all subsequently revised programmes schedules showing the critical path or paths and all necessary logic diagrams demonstrating sequence of operations.

5.1.5.1 Progress Reporting:

- The *Contractor* updates the program and supplies the progress reports to show actual and expected progress compared to the latest agreed Contract Program. Progress information may be verified by the *Project Manager* at any stage.
- The methodology to define work content in the progress curves needs to be agreed to between the *Contractor* and *Employer* within 5 days of Contract Award.
- The work content needs to be specifically designed to suit the type of work and to effectively indicate actual progress against planned progress.
- Progress reports are submitted in line with the requirements as specified in the table below.

Table 5: Progress Reporting Requirements

Item	Description	Frequency
1.	General Planning Report and revised network if logic has changed since the previous report.	Weekly
2.	Critical Activities Report. (Look ahead)	Bi-Weekly
3.	Milestone Report.	Bi-Weekly
4.	Updated Bar Charts.	Bi-Weekly
5.	Updated Program Graphs.	Bi-Weekly
6.	Progress S-Curves.	Bi-Weekly
7.	Expediting Report	Bi-Weekly
8.	Milestones of Deliverables	Bi-Weekly

- The *Contractor* uses the latest version Microsoft Projects (MS Project), Primavera or other applicable project software for his programme submissions or a similar programme software package equivalent to the latest version of the project software subjected to and with the prior written notification and acceptance by the *Project Manager*.

5.1.5.2 Reporting and Monitoring:

- The *Contractor* completes an assessment of all activities in progress and to completion to determine percentage complete, forecast completion dates, deviations from the

Accepted Programme and proposes remedial actions to rectify deviations.

5.1.6 Contract Change Management

- At the Contract kick off meeting, the *Contractor* will be provided with the format of the standard forms to be used for communication of Contract change management.
- All change management processes shall be document accordingly.

5.6.7 Procurement Code of Conduct

Transnet aims to achieve the best value for money when buying or selling goods and obtaining services. This however must be done in an open and fair manner that supports and drives a competitive economy.

5.1.8 The Contractor's Invoices

- The *Contractor* is paid by electronic bank transfer within the period stated in the Contract Data.
- The *Contractor* provides the *Employer* with his correct banking information to make the transfer.
- All payments are provisional and subject to audit.
- The *Contractor* preserves its records for such a period as the Department of Internal Revenue may require, but in any event for not less than five years.
- When the *Project Manager* certifies payment following an assessment date, the *Contractor* complies with the *Employer's* procedure for invoice and statement submission.
- Timing and procedure for submitting invoices will be presented at the kick-off meeting following award.
- The invoice and statement must correspond to the *Project Manager's* assessment of the amount due to the *Contractor* as stated in the payment certificate.
- All other procurement related issues will be handled by the procurement department.

5.1.9 Manpower

- *Contractor* shall ensure that suitably qualified and certified persons are allocated to tasks.
- *Contractor* does not employ or bring a Sub-contractor onto the Site and/or Working Areas without the prior approval of the *Project Manager*.
- Where the *Contractor* employs a Sub-contractor who constructs or installs part of the *Works* or who supplies Plant and Materials for incorporation into the *Works* which involves a Sub-contractor operating on the Site and/or Working Areas, then the *Contractor* ensures that any such Sub-contractor complies with all the safety, risk and quality requirements as stipulated in this documents and as required by the *Employer*.

5.1.10 Plant and Materials

- The *Contractor* shall supply training and maintenance schedules in the data books submitted. These schedules will be added to SAP to ensure that effective maintenance is performed. This will entail monthly inspection and planned maintenance repairs when needed

6 List of Drawings

6.1 Drawings issued by the Employer

This is the list of drawings issued by the *Employer* at or before the Contract Date and which apply to this contract.

Note: Some drawings may contain both Works Information and Site Information.

Description		
Drawing No.	Revision	Description
CIVIL DRAWINGS		
5200157-2-001-C-LA-0001-01	01	STOCKYARD AREA GENERAL LAYOUT
5200157-2-001-C-LA-0001-02	01	STOCKYARD AREA STORMWATER LAYOUT
5200157-2-001-C-LA-0001-03	01	STOCKYARD AREA DEMOLITION LAYOUT
5200157-2-001-C-SE-0001-01	01	STOCKYARD AREA STORMWATER LONG SECTIONS SHEET 1 OF 3
5200157-2-001-C-SE-0001-02	01	STOCKYARD AREA STORMWATER LONG SECTIONS SHEET 2 OF 3
5200157-2-001-C-SE-0001-03	01	STOCKYARD AREA STORMWATER LONG SECTIONS SHEET 3 OF 3
5200157-2-001-C-DE-0001-01	01	STOCKYARD AREA POND DETAILS
5200157-2-001-C-DE-0001-02	01	TYPICAL STORMWATER MANHOLE DETAILS
5200157-2-001-C-DE-0001-03	01	TYPICAL STORMWATER GRID INLET & CATCHPIT DETAILS
5200157-2-001-C-DE-0001-04	01	TYPICAL STORMWATER HEADWALL, SCOUR AND CONCRETE ENCASEMENT DETAILS
5200157-2-001-C-LA-0002-01	01	TIPPLER STORMWATER LAYOUT AND KEY PLAN
5200157-2-001-C-LA-0002-02	01	TIPPLER LAYOUT DETAIL SHEET 1 OF 3
5200157-2-001-C-LA-0002-03	01	TIPPLER LAYOUT DETAIL SHEET 2 OF 3
5200157-2-001-C-LA-0002-04	01	TIPPLER LAYOUT DETAIL SHEET 3 OF 3
5200157-2-001-C-SE-0002-01	01	TIPPLER STORMWATER LONGSECTION SHEET 1 OF 4
5200157-2-001-C-SE-0002-02	01	TIPPLER STORMWATER LONGSECTION SHEET 2 OF 4
5200157-2-001-C-SE-0002-03	01	TIPPLER STORMWATER LONGSECTION SHEET 3 OF 4
5200157-2-001-C-SE-0002-04	01	TIPPLER STORMWATER LONGSECTION SHEET 4 OF 4
5200157-2-001-C-DE-0002-01	01	TIPPLER POND 1, 2 & 4 DETAIL
5200157-2-001-C-DE-0002-02	01	TYPICAL GRID CHANNEL, MOUNTABLE KERB, SUBSOIL COLLECTOR DRAIN (SCD) AND TRAPEZOIDAL CHANNEL DETAIL
5200157-2-001-C-LA-0003-01	01	RAIL EMBANKMENT GENERAL LAYOUT
5200157-2-001-C-LA-0003-02	01	RAIL EMBANKMENT STORMWATER LAYOUT SHEET 1 OF 3
5200157-2-001-C-LA-0003-03	01	RAIL EMBANKMENT STORMWATER LAYOUT SHEET 2 OF 3
5200157-2-001-C-LA-0003-04	01	RAIL EMBANKMENT STORMWATER LAYOUT SHEET 3 OF 3
5200157-2-001-C-SE-0003-01	01	RAIL EMBANKMENT LONGSECTION SHEET 1 OF 6
5200157-2-001-C-SE-0003-02	01	RAIL EMBANKMENT LONGSECTION SHEET 2 OF 6

5200157-2-001-C-SE-0003-03	01	RAIL EMBANKMENT LONGSECTION SHEET 3 OF 6
5200157-2-001-C-SE-0003-04	01	RAIL EMBANKMENT LONGSECTION SHEET 4 OF 6
5200157-2-001-C-SE-0003-05	01	RAIL EMBANKMENT LONGSECTION SHEET 5 OF 6
5200157-2-001-C-SE-0003-06	01	RAIL EMBANKMENT LONGSECTION SHEET 6 OF 6
5200157-2-001-C-DE-0003-01	01	RAIL EMBANKMENT POND 12 & 6 CROSS SECTION DETAIL
5200157-2-001-C-DE-0003-02	01	RAIL EMBANKMENT GRID CHANNEL AND MANHOLE DETAIL
5200157-2-001-C-DE-0003-03	01	RAIL EMBANKMENT KERB DETAIL AND SUBSOIL COLLECTOR DRAIN
5200157-2-001-C-LA-0004-01	01	MULTIPURPOSE TERMINAL STORMWATER LAYOUT & KEY PLAN
5200157-2-001-C-LA-0004-02	01	MULTIPURPOSE TERMINAL DETAILED LAYOUT
5200157-2-001-C-LA-0004-03	01	MULTIPURPOSE TERMINAL DEMOLITION LAYOUT
5200157-2-001-C-SE-0004-01	01	MULTIPURPOSE TERMINAL STORMWATER LONG SECTIONS SHEET 1 OF 3
5200157-2-001-C-SE-0004-02	01	MULTIPURPOSE TERMINAL STORMWATER LONG SECTIONS SHEET 2 OF 3
5200157-2-001-C-SE-0004-03	01	MULTIPURPOSE TERMINAL STORMWATER LONG SECTIONS SHEET 3 OF 3
5200157-2-001-C-DE-0004-01	01	MULTIPURPOSE TERMINAL STILLING BASIN DETAILS
5200157-2-001-C-GA-0005-01	01	CAUSEWAY GENERAL ARRANGEMENT
5200157-2-001-C-LA-0005-01	01	CAUSEWAY PLAN LAYOUT CATCHMENT AREA 1
5200157-2-001-C-LA-0005-02	01	CAUSEWAY PLAN LAYOUT CATCHMENT AREA 2
5200157-2-001-C-LA-0005-03	01	CAUSEWAY PLAN LAYOUT CATCHMENT AREA 3 & 4
STRUCTURAL DRAWINGS		
5200157-2-001-S-DE-0001-01-00	00	STILLING BASIN LADDER AND ACCESS DETAILS
5200157-2-001-S-GA-0001-01-00	00	STILLIN BASINS 1-8 GENERAL ARRANGEMENTS
5200157-2-001-S-DE-0002-01-00	00	STILLIN BASIN SECTIONS AND DETAILS 2 OF 2
5200157-2-001-S-SE-0001-01-00	00	STILLIN BASIN SECTIONS AND DETAILS 1 OF 2
5200157-2-001-S-LA-0001-01-00	00	STILLIN BASINS 1-8 LAYOUTS
5200157-2-001-S-RD-0001-01-00	00	MPT STILLING BASIN WALLS REINFORCEMENT DETAILS
5200157-2-001-S-RD-0002-01-00	00	MPT STILLING BASIN TOP SLAB REINFORCEMENT DETAILS
5200157-2-001-S-RD-0003-01-00	00	MPT STILLING BASIN BEAMS AND COLUMNS REINFORCEMENT DETAILS
5200157-2-001-S-RD-0004-01-00	00	MPT STILLING BASIN FOUNDATION SLAB REINFORCEMENT DETAILS