

TCTA

TENDER NO.: 050/2023/PMID/SHUTDOWN/RFB

LHWP 2024 SHUTDOWN OUTAGE – INSPECTION AND REPAIRS OF DELIVERY TUNNEL NORTH
(DTN) AND EROSION PROTECTION TO ASH RIVER

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C1.2.1 CONDITIONS OF CONTRACT

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PART 1: GENERAL CONDITIONS OF CONTRACT

The Conditions of Contract applicable to this Contract is the FIDIC "Short Form of Contract (First Edition 1999)" published by the Fédération Internationale des Ingénieurs-Conseils (FIDIC), and the "Particular Conditions", which include amendments and additions to the General Conditions.

PART 2: PARTICULAR CONDITIONS OF CONTRACT

The amendments to the General Conditions shall amplify, modify or supersede, as the case may be, FIDIC "Short Form of Contract" to the extent specified below, and shall take precedence and shall govern. These Particular Conditions of Contract form an integral part of the Contract.

The sub-clauses of the Particular Conditions of Contract hereafter are numbered by the number of the applicable sub-clause in the FIDIC "Short Form of Contract", and the applicable heading, or where a new condition that has no relation to the existing clauses is introduced, by a number that follows after the last clause number in the FIDIC Conditions of Contract and an appropriate heading.

1 GENERAL PROVISIONS

1.1 Definitions

In the Conditions of Contract ("these Conditions"), which include Particular Conditions and these General Conditions, the following words and expressions shall have the meanings stated. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

- 1.1.1 "Contract" means the contract Agreement, Letter of Acceptance, the Letter of Tender, these Conditions, the Employer's Requirements, the Schedules, the Contractor's Proposal, and further documents (if any) which are listed in the Contract Agreement on the letter of Acceptance.
- 1.1.2 "Specification" means the document entitled specification, as included in the Contract, and any additions and modifications to the specification in accordance with the Contract. Such document specifies the Works.
- 1.1.3 "Drawings" means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) the Employer in accordance with the Contract.
- 1.1.4 "Employer" means the person named as employer in the Appendix to Tender and the legal successors in title to this person.
- 1.1.5 "Contractor" means the person(s) named as contractor in the Letter of Tender accepted by the Employer and the legal successors in title to this person(s).
- 1.1.6 "Party" means the Employer or the Contractor, as the context requires.
- 1.1.7 "Commencement date" means the 14 days after the date the Agreement comes into effect or any other date agreed between the Parties.
- 1.1.8 "day" means a calendar day and "year" means 365 days.

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- 1.1.9 "Time for Completion" means the time for completing the Works as stated in the Appendix (or as extended under Sub-Clause 7.3), calculated from the commencement date.
- 1.1.10 "Cost" means all expenditure properly incurred (or to be incurred) by the Contractor, whether on or off Site, including overheads and similar charges, but does not include profit.
- 1.1.11 "Contractor's Equipment" means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works and the remedying of any defects. However, Contractor's Equipment excludes Temporary Works, Employer's Equipment (if any), Plant, Materials and any other things intended to form or forming part of the Permanent Works.
- 1.1.12 "Country" means the country in which the Site (or most of it) is located, where the Permanent Works are to be executed.
- 1.1.13 "Employer's Liabilities" means matters listed in Sub-Clause 6.1.
- 1.1.14 "Force Majeure"
- Replace with:
- "Force Majeure" means an exceptional event or circumstance:
- a) which is beyond a Party's control,
 - b) which such Party could not reasonably have provided against before entering into the Contract,
 - c) which, having arisen, such Party could not reasonably have avoided or overcome, and
 - d) which is not substantially attributable to the other Party.
- Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:
- i. war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
 - ii. rebellion, terrorism, revolution, insurrection, military or usurped power, or civil war,
 - iii. riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel and other employees of the Contractor and Sub-contractors,
 - iv. munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and
 - v. natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.
- Add 1.1.14. 1
- A "Notice of Force Majeure" notice submitted to the other party if a Party is or will be prevented from performing any of its obligations under the Contract by Force Majeure, the Party shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given forthwith after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.
- The Party shall, having given notice, be excused performance of such obligations for so long as such Force Majeure prevents it from performing them.
- Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract.
- 1.1.15 "Materials" means things of all kinds (other than Plant) intended to form or forming part of the Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.
- 1.1.16 "Plant" means the apparatus, machinery and vehicles intended to form or forming part of the Permanent Works.

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- 1.1.17 "Site" means the places where the Permanent Works are to be executed and to which Plant and Materials are to be delivered, and any other places as may be specified in the Contract as forming part of the Site.
- 1.1.18 "Variation" means any change to the Works, which is instructed or approved as a variation under Clause 10.1 [Variations and Adjustments].
- 1.1.19 "Works" mean the Permanent Works and the Temporary Works, or either of them as appropriate.

Sub-Clause 1.2 Interpretation

- ***Delete the whole paragraph and replace with***

In the Contract, except where the context requires otherwise:

- a) words indicating one gender include all genders;
- b) words indicating the singular also include the plural and words indicating the plural also include the singular;
- c) provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing, and
- d) "written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record.
- e) Where, in these Conditions, provisions include the expression "Cost plus reasonable profit" this profit is deemed to be one-twentieth (5%) of this Cost.

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

Sub-Clause 1.5 Communications

- ***Delete the whole paragraph and replace with***

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices and requests, these communications shall be:

- a) in writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the Appendix to Tender; and
- b) delivered, sent or transmitted to the address for the recipient's communications as stated in the Appendix to Tender. However:
 - I. if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and
 - II. if the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued.

Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed. When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Employer's Representative, a copy shall be sent to the Employer's Representative or the other Party, as the case may be.

Sub-Clause 1.6 Compliance with Laws

- ***Delete the whole paragraph and replace with***

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated in the Particular Conditions the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the Laws in relation to the execution and completion of the Works and the remedying of any defects; and the Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so.

Sub-Clause 3.3 Employer's Representative

- ***Add a new paragraph 3.3 [Determination]:***

Whenever these Conditions provide that the Employer's Representative shall proceed to agree or determine any matter, the Employer's Representative shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Employer's Representative shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.

The Employer's Representative shall give notice to both Parties of each agreement or determination, with supporting particulars. Each Party shall give effect to each agreement or determination unless and until revised under Clause 15 [Resolution of *Disputes*].

4. The Contractor

4.1 General Obligations

- ***Delete the whole paragraph and replace with***

The Contractor shall execute and complete the Works in accordance with the Contract and with the Employer's representative's instructions, and shall remedy any defects in the Works.

The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this design, execution, completion and remedying of defects.

The Contractor shall be responsible for the adequacy, stability and safety of all Site operations and of all methods of REFURBISHMENT. Except to the extent specified in the Contract, the Contractor (i) shall be responsible for all Contractor's Documents, Temporary Works, and (ii) shall not otherwise be responsible for the design or specification of the Permanent Works.

The Contractor shall liaise and co-operate with the Employer's representative provide them with such access, information and facilities as they may reasonably require in order to enable them to perform their duties under the Contract.

The Contractor shall, whenever required by the Employer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this having previously been notified to the Employer's Representative.

4.2 Contactor's Representative

- ***Delete the whole paragraph and replace with***

The Contractor shall appoint the Contractor's Representative and shall give him all authority necessary to act on the Contractor's behalf under the Contract.

Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement Date, submit to the Employer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is withheld or subsequently revoked, or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of another suitable person for such appointment.

The Contractor shall not, without the prior consent of the Employer, revoke the appointment of the Contractor's Representative or appoint a replacement.

The whole time of the Contractor's Representative shall be given to directing the Contractor's performance of the Contract. If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement person shall be appointed, subject to the Employer's prior consent, and the Employer shall be notified accordingly.

Add 4.5 Advance Payment reading as follows:

The Employer shall make an advance payment, as an interest-free loan for mobilisation, when the Contractor submits a guarantee. The total advance payment, the number and timing of instalments and proportions, shall be as stated in the Appendix to Tender.

Unless and until the Employer receives this guarantee, this Sub-Clause shall not apply and the Contractor shall ensure that the guarantee is valid and enforceable until the advance payment has been repaid, but its amount may be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. If the terms of the guarantee specify its expiry date, and the advance payment has not been repaid by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been repaid.

Unless an extended guarantee is submitted to the Employer 28 days prior to the expiry of the Advance Payment Guarantee, the Employer in his sole discretion will suspend further payments due to the Contractor until such extension evidence is received or deduct the full balance or part thereof from any monies that may have become due to the Contractor.

5. Design by Contractor

Sub-Clause 5.1 Contactor's Design

- ***Delete the whole paragraph***

Sub-Clause 5.2 Responsibility for Design

- *Delete the whole paragraph*

6. Employer's Liabilities

- *Delete p) in Sub-Clause 6.1*

7. Time for Completion

Sub-Clause 7.3 Extension of Time for Completion

The Contractor shall be entitled subject to Sub-Clause 10.3 to an extension of the Time for Completion if and to the extent that completion for the purposes of Clause 8 [Taking –Over] is or will be delayed by any of the following causes:

- a) a Variation (unless an adjustment to the Time for Completion has been agreed) or other substantial change in the quantity of an item of work included in the Contract evaluated in accordance with Clause 10 hereof,
- b) a cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions,
- c) exceptionally adverse climatic conditions, including conditions arising as a consequence of exceptionally adverse climatic conditions, in excess of the number of working days' delay, which must be allowed for by the Contractor in his programme on a cumulative basis over the whole Contract period,
- d) Unforeseeable shortages in the availability of personnel or Goods caused by epidemic or governmental actions, or
- e) any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other contractors on the Site.

Contractor shall make allowance in his programmes for delay to the progress of the whole of the Works due to climatic conditions or conditions arising as a consequence of climatic conditions for the number of working days as stated in the Appendix to Tender.

Any delay in excess of the number of working days shall, for the purpose of this Sub-Clause, constitute exceptionally adverse climatic conditions. Provided that all such delays shall be recorded and agreed with the Employer's Representative daily from the commencement to the conclusion of each occurrence and the allowance shall be cumulative over the entire Contract period up to the commencement of the Defects Notification Period for the whole of the Works.

Notwithstanding anything contained elsewhere in the Contract no extension of the Time for Completion of the Works on account of exceptionally adverse climatic conditions or conditions arising as a consequence of climatic conditions will be considered as cause for additional payment to the Contractor.

If the Contractor considers himself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Employer's Representative in accordance with Sub-Clause 10.3 [Early Warning]. When determining each extension of time, the Employer's Representative shall review previous determinations and may increase, but shall not decrease, the total extension of time.

Notwithstanding anything to the contrary in the Contract, the Contractor shall not be entitled to an extension of the Time for Completion where he has not used all reasonable endeavours to prevent, reduce or mitigate the delay, including providing such temporary measures as may be necessary to enable work to continue and the Works and Contractor's Equipment to be protected during exceptionally adverse climatic conditions.

8. Taking-Over

Sub-Clause 8.1 Completion

- ***Delete the whole paragraph and replace with***

The Contractor shall complete the whole of the Works within the Time for Completion for the Works including:

- a) achieving the passing of the Tests on Completion, and
- b) completing all work which is stated in the Contract as being required for the Works to be considered completed for the purposes of taking-over .

The shall notify the Employer when he considers that the Works are complete.

9. Remedying Defects

Sub-Clause 9.1 Remedying Defects

- ***Delete the whole paragraph and replace with***

In order that the Works and Contractor's Documents be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall:

- a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Employer's Representative, and
- b) execute all work required to remedy defects or damage, as may be notified by (or on behalf of) the Employer on or before the expiry date of the Defects Notification Period for the Works.

If a defect appears or damage occurs, the Contractor shall be notified accordingly, by (or on behalf of) the Employer.

Cost of Remedying Defects

All Outstanding Work and Remedying Defects shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

- a) Plant, Materials or workmanship not being in accordance with the Contract,
- b) failure by the Contractor to comply with any other obligation, or

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- c) improper operation or maintenance which was attributable to matters for which the Contractor is responsible.

If and to the extent that such work is attributable to any other cause, the Contractor shall be notified promptly by (or on behalf of) the Employer, and Clause 10. [*Variation and Claims*] shall apply.

Sub-Clause 9.2 Uncovering

- ***Delete the whole paragraph and replace with***

The Employer may give instruction as to the uncovering of any work. Unless as result of any uncovering it is established that the Contractor's Material, Plant or workmanship are not in accordance with the Contract, the Contractor shall be paid for such uncovering in accordance with Sub-Clause 10.2

Sub-Clause 9.2A Testing

- ***Add the following***

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

The Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently. The Contractor shall agree, with the Employer's Representative, the time and place for the specified testing of any Plant, Materials and other parts of the Works.

The Employer's Representative may, under Clause 10 [Variations and Claims], vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract.

The Employer's Representative shall give the Contractor not less than 24 hours' notice of the Employer's Representative's intention to attend the tests. If the Employer's Representative does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise instructed by the Employer's Representative, and the tests shall then be deemed to have been made in the Employer's Representative's presence.

If the Contractor suffers delay and/or incurs Cost from complying with these instructions or as a result of a delay for which the Employer is responsible, the Contractor shall give notice to the Employer's Representative and shall be entitled to:

- a) an extension of time for any such delay, if completion is or will be delayed, and
- b) payment of any such Cost plus reasonable profit, which shall be included in the Contract Price.

After receiving this notice, the Employer's Representative shall proceed in accordance with Sub-Clause 3.3 [Determinations] to agree or determine these matters.

The Contractor shall promptly forward to the Employer's Representative duly certified reports of the tests. When the specified tests have been passed, the Employer's Representative shall endorse the Contractor's test certificate, or issue a certificate to him, to that effect. If the Employer's Representative has not attended the tests, he shall be deemed to have accepted the readings as accurate.

Sub-Clause 9B Rejection

- ***Add the following***

If, as a result of an examination, inspection, measurement or testing, any Plant, Materials or workmanship is found to be defective or otherwise not in accordance with the Contract, the Employer's Representative may reject the Plant, Materials or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

If the Employer's Representative requires this Plant, Materials or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Employer to incur additional costs, the Contractor shall pay these costs to the Employer.

If, despite the Employer's Representative's rejection of Plant, Materials or Workmanship as above, the Employer decides at his discretion, having regard to the circumstances of the specific case only, to accept the item of work for any reason, such concession will not constitute any precedent nor detract in any other way from the Contract or Contractor's obligations and responsibilities for otherwise full compliance. In this event, the concession will be made subject to a reduced payment for the Plant, Materials or Workmanship as determined by the Employer's Representative in accordance with Sub-Clause 3.3 [*Determinations*]. Such concession will be without prejudice to the Employer's rights and the Contractor's obligations under the Contract and the item of work will be treated under Sub-Clause 9.1 [*Remedying Defects*].

Sub-Clause 13.1.

Delete last paragraph starting with "Unless....." and replace with:

Unless the loss or damage happens as a result of an Employer or backfilling after pipe installation by Department of Water and Sanitation REFURBUISHMENT, the Contractor shall indemnify the Employer, the Employer's Contractor, agents, employees as well as DWS REFURBUISHMENT, the DWS' agents, and employees against all loss or damage happening to the Works and against all claims or expense arising out of Works caused by breach of the Contract, by negligence or by other default of the Contractor, his agents or employees.

PART C2: PRICING DATA

C.2.1 PRICING INSTRUCTIONS

1. Measurement and payment shall be in accordance with the relevant provisions of Clause 8 of each of the SABS 1200 Standardised Specifications for Civil Engineering Construction subject to the variations and amendments contained in the section “Applicable SABS 1200 standardised specifications”, referred to in the Scope of Work. The Preliminary and General items shall be measured in accordance with the provisions of SABS 1200-A General and AB Engineer’s Office.

These Bills of Quantities form part of the contract documents and must be read in conjunction with all the other documents comprising the contract documents.

2. The units of measurement described in the Bills of Quantities are metric units. Abbreviations used in these Bills of Quantities are as follows:

%	=	percent
h	=	hour
ha	=	hectare
kg	=	kilogram
kℓ	=	kilolitre
km	=	kilometre
km-pass	=	kilometre-pass
kPa	=	kilopascal
kW	=	kilowatt
ℓ	=	litre
m	=	metre
mm	=	millimetre
m ²	=	square metre
m ² -pass	=	square metre-pass
m ³	=	cubic metre
m ³ -km	=	cubic metre-kilometre
MN	=	meganewton
MN.m	=	meganewton-metre
MPa	=	megapascal
Month	=	calendar month
No	=	number
pr	=	pair
Prov sum	=	Provisional sum
PC sum	=	Prime Cost sum
R/only	=	Rate only

sum = lump sum
t = ton (1000 kg)
W/day = Work day

For the purposes of this Bill of Quantities, the following words shall have the meanings hereby Unit: The unit of measurement for each item of work as defined in the Standardized, Project or

Quantity : The number of units of work for each item

Rate : The payment per unit of work at which the Tenderer Tenders to do the work

Amount : The quantity of an item multiplied by the tendered rate of the (same) item

Sum : An amount tendered for an item, the extent of which is described in the Bill of Quantities, the Specifications or elsewhere, but of which the quantity of work is not measured in units

3. Unless otherwise stated, items are measured net in accordance with the drawings, and no allowance is made for waste.
4. The prices and rates in these Bills of Quantities are fully inclusive prices for the work described under the items. Such prices and rates cover all costs and expenses that may be required in and for the execution of the work described in accordance with the provisions of the Scope of Work, and shall cover the cost of all general risks, liabilities, and obligations set forth or implied in the Contract Data, as well as overhead charges and profit. These prices will be used as a basis for assessment of payment for additional work that may have to be carried out. The rates cover all costs, including plant and materials, to measure and achieve the requirements of the project specifications.
5. It will be assumed that prices included in these Bills of Quantities are based on Acts, Ordinances, Regulations, By-laws, International Standards and National Standards that were published 28 days before the closing date for tenders. (Refer to www.stanza.org.za or www.iso.org for information on standards)
6. Where the Scope of Work requires detailed drawings and designs or other information to be provided, all costs associated therewith are deemed to have been provided for and included in the unit rates and sum amount tendered such items
7. The quantities set out in these Bills of Quantities are approximate and do not necessarily represent the actual amount of work to be done. The quantities of work accepted and certified for payment will be used for determining payments due and not the quantities given in the Bills of Quantities.
8. The short descriptions of the items of payment given in these Bills of Quantities are only for the purposes of identifying the items. More details regarding the extent of the work entailed under each item appear in the Scope of Work.
9. Descriptions in the Bills of Quantities are abbreviated and comply generally with those in the SABS 1200 Standardised Specifications for civil engineering works. Descriptions in the Bill of Quantities are abbreviated and comply with the project specifications.
10. The Tenderer shall enter a rate or lump sum for each item in the Schedule of Quantities in BLACK INK (hard copy).

11. The Bills of Quantities must be completed by the insertion of rates / prices in accordance with the instructions described in the items above. As this contract is a Re-measurable Contract and Not a Lump Sum Contract, a blank Bill of Quantities with only a lump sum amount will not be accepted.

12. A price or rate is to be entered against each item in the Price Schedule, whether the quantities are stated or not. An item against which no price is entered or where a word or phrase such as "included" or "provided elsewhere" will be accepted as a rate of nil (R0,00) having been entered against such items and covered by the other prices or rates in the Schedule.

Any work executed to which such a pay item applies, shall be measured under the appropriate items in the Price Schedule and valued at a rate of nil (R0,00). The rate of nil shall be valid irrespective of any change in the quantities during the execution of the Contract.

13. All prices or rates inserted in the Bill of Quantities shall be EXCLUDING VAT. Provision has been made on the Summary Page, of the Bill of Quantities, for the addition of VAT.

14. Arithmetical errors of responsive tenders will be corrected in the following manner:

Where there is a discrepancy between an amount shown in figures, and the corresponding amount stated in words, the amount stated in words shall take preference.

In the Bill of Quantities, if there is an error in the line item total resulting from the product of the quantity and the unit rate, the line item total shall govern, and the rate shall be corrected. Where there is a misplacement of the decimal point in the unit rate, the line item total shall govern and the unit rate will be corrected.

Where there is an error in the total of the prices either as a result of other corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall govern and the tenderer will be asked to revise selected item prices (and their rates in the Bill of Quantities) to achieve the tendered total of the prices.

Should a tenderer be unwilling to make the corrections ordered by the Employer's Agent, the tender may be disqualified.

15. The value of the certificates issued shall be adjusted in accordance with the Contract Price Adjustment Schedule as detailed in Part 1: Contract specific data provided.

16. Any entry made by the Tenderer in the Price Schedule, forms, etc, which the Tenderer desires to change, shall not be erased or painted out. A line shall be drawn through the incorrect entry and the correct entry shall be written above in black ink and the full signature of the Tenderer shall be placed next to the correction.

The Employer shall determine the amount to be paid for the Contract Participation Goal (CPG) on the contract and this amount shall be stated under the section Enterprise Development as a **Provisional Sum** in the Preliminaries and Generals (P&Gs).

NOTE:

Tenderers are to refer to the Scope of Works and in particular the Specification Data when pricing the Bills of Quantities.

PART C3: SCOPE OF WORKS

C3.1 Description of the Works

C3.1.1 Employer’s objectives

A system outage is required in 2024 for scheduled maintenance works in accordance with the requirements of the Tunnel Operations and Maintenance (O&M) manuals as well as the 2019 outage recommendations.

- a. The objective of the project is to provide for a minimum contract participation goal (CPG) of 5% of the total project value and to develop targeted enterprises by the main or lead partner contractors.
- b. The successful contractor shall:
 - 1. Subcontract a minimum of 5% of the total project value to targeted enterprises;
 - 2. develop the targeted enterprise/s in two development areas as specified in the Standard, and agreed by both the main contractor and the targeted enterprise/s;
 - 3. perform needs analysis on the targeted enterprise to identify developmental goals;
 - 4. provide internal mentorship support to improve the targeted enterprise/s performance;
 - 5. develop a project specific enterprise development plan to improve the targeted enterprise/s performance in the identified developmental areas;
 - 6. monitor and report the progress of the agreed development areas with the targeted enterprise/s; and
 - 7. submit a project completion report to the Employer’s representative for each targeted Enterprise
- c. The development of the Targeted Enterprise shall be guided by the **CIDB Competence Standard for Contractors Gazette No. 41237, 10 November 2017. Table 2.** below outlines the minimum recognised qualifications to which development of targeted enterprises must be undertaken by the main contractor.

1. Table 2. Recognised Qualifications

CIDB Grade	Minimum NQF Level	Recognised Qualifications
Business Management		
5 & 6	5	<ul style="list-style-type: none"> • National Occupational Qualification in Business Management NQF 5
2 to 4	2	<ul style="list-style-type: none"> • National Certificate: Construction Contracting NQF 2
Building and Construction Works Management		
5 & 6	5	<ul style="list-style-type: none"> • National Certificate: Management of Building Construction Processes NQF 5
2 to 4	3	<ul style="list-style-type: none"> • NCV 4: Civil Engineering and Building Construction, or • National Certificate: Supervision of Construction Processes
Civil Engineering Construction Works		
5 & 6	5	<ul style="list-style-type: none"> • National Certificate: Management of Civil Engineering Processes NQF 5, or • National Diploma: Civil Engineering and Building Diploma
2 to 4	3	<ul style="list-style-type: none"> • NCV 4: Civil Engineering and Building Construction or • National Certificate: Supervision of Construction Processes, or • Further Education and Training Certificate: Supervision of Construction Processes

Source; cidb Competence Standard for Contractors; Gazette Notice No. 41237

C3.1.2 Overview of the Works

The scope of work includes Site Establishment & Mobilization of all Resources including competent personnel with relevant experience, equipment and tools, spares, material, transportation, delivery to site, storage, repairs, testing & commissioning, performance guarantee testing, and handing over to TCTA. Details of the work activities is contained in section C3.3.

The contractor shall provide a competent person/s to provide internal mentorship to the Targeted Enterprise/s in the two agreed developmental areas.

C3.1.3 Extent of the Works

The extent of the works for the 2024 shutdown is for all repair works for Mechanical, Electrical, Civil and General engineering repairs of the Delivery Tunnel North and Ash River of the Lesotho Highlands Water Project 1.

C3.1.4 Location of the Works

The location of the works is detailed in section C4 Site Information.

C3.1.5 Dealing with Water

During the shutdown period the Contractor can expect an infiltration flow of 4 litres/sec on the Caledon Siphon and 40 litres/sec at the Little Caledon Siphon which must be controlled via diversions, weirs and dewatering pumps.

The contractor shall be responsible for supplying all cleaning water on site.

C3.1.6 Power Requirements

There is a limited electrical supply available (welding plug), when there is no loadshedding, at the Little Caledon Dewatering Shaft. The contractor must make allowance for the supply of power to the site camp and to all electrical equipment as and when required.

C3.1.7 Phasing of the Works

The project requires the contractor to undertake the pre-shutdown activities as listed in section C3.3 during the four-month mobilisation period. The contractor's full project team is only required on site for the shutdown, however site establishment must be complete two months before the shutdown commences.

C3.1.8 Construction Management

Monthly progress meetings will be held on site where the Contractor shall report on the progress measured against the approved construction programme together with cashflows. The Contractor shall prepare detailed method statements for each activity detailing the personnel, safety measures, materials, plant and tools, hold points, testing and quality control procedures prior to undertaking the activities.

The contractor shall submit to the Employer's representative:

1. Project interim reports in the specified format (ED105P) detailing interim value of the CPG that was achieved. Such a report shall also contain a monthly progress report, compiled by the employer's representative and the contractor, detailing an assessment of the enterprise development support provided.
2. Project completion report, in the specified format (ED101P), to the Employer's Representative for acceptance within 15 days of achieving practical completion. The report shall include the value of the CPG that was certified in accordance with the contract, cidb registration numbers of each and every targeted enterprise and the value of the subcontracted works or the participation parameter of the joint venture entered into; and
3. Enterprise development declaration (ED104P).

C3.2 Procurement

C3.2.1 Contract Participation

All unskilled labour is to be local labour and full time security for the site camp and all access points to the tunnel, except for the security at the Caledon South Access Adit, which will be supplied by LHDA, must be sourced from local security companies.

C3.2.2 Contract Participation Goal

The contractor shall appoint an Enterprise Development Co-ordinator who shall:

- a) develop a project specific Enterprise Development plan to improve the targeted enterprise's performance in the identified developmental areas and shall allocate resources to monitor progress in relation to improved performance; and
- b) shall, submit to the employer's representative a monthly enterprise development report (Performa – ED105P) which documents all mentoring activities that have taken place during that month and the progress made in improving the targeted enterprise's performance in the agreed developmental areas, countersigned by the targeted enterprise.

C3.2.3 Competence Criteria for an Enterprise Development Co-ordinator

The enterprise development co-ordinator shall have the following competencies:

- a) Minimum experience of 5 years in the construction industry at Managerial level as a Site Agent, Contracts Manager, Site Manager, Construction Manager, Business Development Manager or Enterprise Development Manager.
- b) Minimum experience of 2 years in training and development in Building or Construction; and
- c) National Diploma or B Degree in the Built Environment or Business Management

C. 3.3: WORK ACTIVITIES

Pre-Shutdown items				
I. Site establishment - next to Little Caledon Dewatering Shaft, with ablution and security guards, Google coord -28,5353184, 28,4372366				
II. LiDAR contractor procurement - air borne LiDAR, ± 22km long & average width of 0.8km at Bethlehem, Free State. No flow Ash River from near Clarens to Bethlehem – Saul's Plaatje dam.				
III. Load testing all lifting equipment's & Install Electrical hoists at both Dewatering shafts - 5 x 3ton chain blocks attached to crawl beam, monorail and 1 X 1 chain block from storage. The electrical hoists are at the dewatering shafts and the others are at the adits.				
IV. Install Pumps & Controls and test – 2 X dry submersible dewatering pumps and 2 X Sump Pumps at Dewatering shafts. Free issue of pumps.				
V. C.O.C's for 2 X Dewatering Shafts.,				
VI. Remove Dihlabeng municipal water pipe and re-install after shutdown - 700mm diameter. New gaskets to be installed.				
VII. Inspect & Service Ventilation systems at both Dewatering shafts - Donkin Marax 2, 560 diameter and Caledon North adit -Donkin Series HBC-M size 630 1.0 width Class 4- DuctAir systems.				
VIII. Procure Bulkhead "O" rings 10mm diameter and glue, neoprene rubber 75 shore				
IX. Procure 3 sets of Bulkhead 64 threaded studs M42, 128 washers, 128 Nuts, all grade 8 x 8 hot dip galvanised, torque to 1700 Nm				
Shutdown items				
Area	Lining Type	Diameter	Length	Remarks
		(m)	(m)	
1. Caledon South Audit Bulkhead	Steel & concrete	3	20 & 25	Access from RSA Caledon North Adit and through Caledon River Crossing
LHDA - open the Adit & Main door & Place a guard - for ventilation				
I. Cleaning of steel sections & Dome				
II. Inspection & NDT pitted areas				
III. Repair steel liner if in excess of minimum NDT thickness				
IV. Sand Blast steel pipe				
V. Sand blast axillary steel items including the dome				
VI. Epoxy coating steel lining, dome and axillary items				
VII. Disposal of sand blast residue				
VIII. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs				
IX. Install filter systems to prevent blast grit entering the river				
2. Caledon River Crossing South	Concrete	4,5	104	
I. Cleaning of chainage maker points				
II. Inspection of tunnel				
III. Repair concrete where needed				
IV. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs. Tunnel is at an angle (1:10)				

3. Caledon River Crossing Siphon	Steel	3,4	486	
I. Cleaning of steel sections, high pressure washer, extra water ready				
II. Inspection & NDT pitted areas				
III. Repair steel liner if in excess of minimum NDT thickness				
IV. Ventilation system set up, Caledon North & South Adits				
V. Sand Blast steel pipe liners & Trash grid				
VI. Sand blast axillary steel items to dewatering shaft.				
VII. Epoxy coating steel lining and axillary items				
VIII. Disposal of sand blast residue				
IX. Use mobile aluminium scaffolding with rubber castor wheels& lighting for Inspection & Repair. Lifeline anchor scaffolding when in use to tunnel anchor points				
X. Paint on chainage maker points				
4. Caledon River Crossing North	Concrete	4,5	130	
I. Cleaning of chainage maker points				
II. Inspection of tunnel				
III. Repair concrete where needed				
IV. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs. Tunnel is at an angle (1:10)				
5. Caledon Dewatering Shaft	Pumps/piping's		40	
I. Load test of lifting system install electric hoist - pre-shutdown				
II. Inspect ventilation system - pre-shutdown				
III. Install pumps & Controls-pre-shutdown				
IV. Replace 50mm diameter sump pump, line & NRV, rope access crew - pre-shutdown				
V. Inspect main pump piping's and NRV 700mm diameter piping				
VI. Inspect Shaft - safety harnesses/rope access				
VII. DB Boards C.O.C – pre-shutdown				
VIII. Inspect 600mm & 250 mm butterfly valve, anodes, if need repair remove to the shop for repairs				
IX. Install filter systems to prevent blast grit entering the river				
X. Install heavy duty perimeter fencing 42mX2,4m with heavy duty 4,5m sliding gate				
6. Caledon North Adit Bulkhead	Steel & concrete	3	21 & 51	Vehicular Access
I. Inspect ventilation system - pre-shutdown				
II. Install mobile ablution facility				
III. Place a guard				
IV. Load test of lifting system - pre-shutdown				
V. Open bulkhead, put in packing bay & Investigate leak				
VI. Place conveyor mats, dome ramp, water diversions				
VII. Cleaning of steel sections & Dome				
VIII. Inspection & NDT pitted areas				
IX. Repair steel liner if in excess of minimum NDT thickness				
X. Sand Blast steel pipe and dome				
XI. Sand blast axillary steel items				

XII. Epoxy coating steel lining, dome and axillary items				
XIII. Disposal of sand blast residue				
XIV. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs				
XV. Install filter systems to prevent blast grit entering the river				
7. Caledon VS6A Drive	Concrete	4,5 & 5,77	74 & 569	
I. Cleaning of chainage maker points				
II. Inspection of tunnel				
III. Repair concrete where needed				
IV. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs				
8. Caledon access and entrance				
I. Repair of Gabions and shotcrete/sprayed concrete the gabions wall to specification				
II. Install heavy duty car parking entrance fence and gate 20m X2.4m with heavy duty 4,5m sliding gate				
9. VS No. 6A	HDPE pipe	0,23	73 m Deep	ventilation
I. Inspect the vent shaft cap				
10. Caledon Drive	Segment Lining	4,6	7 040	
I. Cleaning of chainage maker points				
II. Inspection of tunnel				
III. Repair concrete where needed & grout plugs where missing				
IV. Asses with diesel/electric golf cart with ample lights from Little Caledon/low cover section, must be able to drive back or two golf carts back to back solid connected to pull forward and push back				
V. Water diversions to low cover section				
11. Low Cover Section	Steel	3,4	215	
I. High pressure cleaning of steel sections, extra water ready				
II. Unblock the low cover section drainpipe under the low cover steel liners. 3Cr12, 50mm Diameter Length of low cover section				
III. Inspection & NDT pitted areas				
IV. Repair steel liner if in excess of minimum NDT thickness				
V. Ventilation system set up, Little Caledon South Adit				
VI. Asses with diesel golf cart with ample lights from Little Caledon/low cover section, must be able to drive back or two back to back pull				
VII. Epoxy coating steel lining and axillary items				
VIII. Disposal of sand blast residue				
IX. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs				
X. Paint on chainage markers				
12. Caledon Tunnel Drive	Segment Lining	4,6	781	
I. Cleaning of chainage maker points				
II. Inspection of tunnel				
III. Repair concrete where needed & grout plugs where missing				
IV. Asses with diesel/electric golf cart with ample lights from Little Caledon/low cover section, must be able to drive back or two golf carts back to back solid connected to pull forward and push back				
V. Water diversions to low cover section				
13. Little Caledon South Drive	Concrete	5,77	211	

I. Cleaning of chainage maker points				
II. Inspection of tunnel				
III. Repair concrete where needed				
IV. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs				
14. Little Caledon Tunnel Bypass Off-take	Concrete	2,4	52	
I. Cleaning of chainage maker points				
II. Inspection of tunnel				
III. Repair concrete where needed				
IV. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs				
15. Little Caledon Tunnel Bypass Off-take	Steel	1,6	119	
I. Remove plank slabs with a crane with rigger 5 ton if valves to be removed.				
II. Inspection of 2 x 1600 valves, anodes and pipework				
III. Repair as necessary valves and pipework				
IV. Cleaning of steel sections, brooms, scotch brite, extra water ready				
V. Inspection & NDT pitted areas				
VI. Repair steel liner if in excess of minimum NDT thickness				
VII. Ventilation system set up, at bypass				
VIII. Asses area & lighting				
IX. Sand blast all steel lining and auxiliary equipment				
X. Epoxy coating steel lining and axillary items				
XI. Disposal of sand blast residue				
XII. Installation of plank slabs with crane 5 ton and seal with Polyurethane Joint Sealant to seal (Sikaflex-Pro 2HP) SUPPLIERS < SIKA, if plank slabs were removed for valves.				
16. Little Caledon South Adit Bulkhead	Steel & concrete	3	7 & 6	Vehicular access
I. Install mobile ablution facility				
II. Place a guard				
III. Load test of lifting system- pre-shutdown				
IV. Open bulk head, put in packing bay & Investigate leak				
V. Place conveyor mats, dome ramp, water diversions				
VI. Cleaning of steel sections & Dome				
VII. Inspection & NDT pitted areas				
VIII. Repair steel liner if in excess of minimum NDT thickness				
IX. Sand Blast steel pipe, dome.				

X. Sand blast axillary steel items				
XI. Epoxy coating steel lining, dome and axillary items				
XII. Disposal of sand blast residue				
XIII. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs				
XIV. Install filter systems to prevent blast grit entering the river				
17. Air Valve South	S/S pipe and Air valve	0,15	8m deep	ventilation
I. Inspect Air 150mm NB gate S/S valve, vent				
II. Repair as necessary replace valve				
18. Little Caledon Crossing Siphon	Concrete	4,5	636	
I. Cleaning of chainage markers				
II. Inspection of tunnel				
III. Repair concrete where needed				
IV. Sand blast steel items i.e. trash grit				
V. Epoxy coating and axillary items				
VI. Disposal of sand blast residue				
VII. Use mobile aluminium scaffolding with rubber castor wheels& lighting for Inspection & Repair. Lifeline anchor scaffolding when in use to tunnel anchor points				
19 . Little Caledon Dewatering Shaft			20	
I. Load test of lifting system install electric hoist-pre-shutdown				
II. Inspect & service ventilation system - pre-shutdown				
III. Install pumps & Controls - pre-shutdown				
IV. Inspect main pump piping's and NRV 700mm diameter piping's & inspect 50mm diameter sump pump line & NRV, rope access crew, repair, sand blast and recoat if required.				
V. Inspect Shaft - safety harnesses/rope access				
VI. DB Boards C.O.C -pre-shutdown				
VII. Inspect 2 x 900 mm Valves, anodes, if repairs required remove to the shop for repairs				
VIII. Install filter systems to prevent blast grit entering the river				
20. Little Caledon North Adit Bulkhead	Steel & concrete	3	7 & 6	Vehicular access
I. Install mobile ablution facility				
II. Place a guard				
III. Load test of lifting system - pre-shutdown				

IV. Open bulkhead, put in packing bay & Investigate leak				
V. Place conveyor mats, dome ramp, water diversions				
VI. Cleaning of steel sections & Dome				
VII. Inspection & NDT pitted areas				
VIII. Repair steel liner if in excess of minimum NDT thickness				
IX. Sand Blast steel pipe and dome				
X. Sand blast axillary steel items				
XI. Epoxy coating steel lining, dome and axillary items				
XII. Disposal of sand blast residue				
XIII. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs				
XIV. Install filter systems so that blast grit is not going to river				
XV. Paint on chainage markers				
21. Air Valve North	S/S pipe and Air valve	0,15	8m deep	ventilation
I. Inspect Air 150mm NB gate S/S valve, vent				
II. Repair as necessary replace valve				
22. Little Caledon North Drive	Concrete	4,5	93	
I. Cleaning of chainage maker points				
II. Inspection of tunnel				
III. Repair concrete where needed				
IV. Mobile aluminium scaffolding with rubber castor wheels & lighting required for repairs				
23. Ash Tunnel Drive	Segment Lining	4,6	10 987	
I. Cleaning of chainage maker points				
II. Inspection of tunnel				
III. Repair concrete where needed & grout plugs where missing				
IV. Asses with diesel van with ample lights from Little Caledon north adit to Ash outfall				
24. Ash Outfall	Concrete	4,6	10	Vehicular Access
I. Repair stop logs paint before shutdown and put in place with Crane and rigger use 5 ton				
II. Cleaning of algae & debris & dispose to approved dumping				
III. Inspection of Ash Outfall & joints				
IV. Repair concrete where needed				
V. Repair: use mobile scaffolding with castor wheels or rope access				
VI. Access normal scaffolding tower with castor wheels				
VII. Access normal scaffolding tower with castor wheels on the jump side, with access ladder scaffolding				

VIII. Contractor to clean and supply access for DWS (Bloemfontein) structure survey on the gauging weir.				
IX. Remove stop logs to storage Crane use 5 ton at the end of the shutdown.				
25. Ash River	River		26 000	
I. LiDAR survey				
II. On foot river inspection by PSP				
III. Recommended repairs by PSP to river & structures				
IV. Remove trees, boulders impeding water flow				
V. Erosion protection where instructed by PSP i.e. rip-rap stones				
After/End-Shutdown items				
VI. Close domes 10mm rubber "O" ring, 1700 Nm torquing				
VII. Lift stop logs at the end of shutdown, repair, repaint and put back to storage				
VIII. Install Dihlabeng municipal piping connection 700mm Diameter				
IX. Inspection for water leaks and attending to water leaks during filling - CONTRACTOR.				
X. Rehabilitate the site established area				

C3.4 SPECIFICATIONS

3.4.1 SANS/SABS 1200 SPECIFICATIONS

GENERAL AMENDMENTS

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

Change all references to "SABS 1200" to read "SABS/SANS 1200".

AMENDMENTS TO SANS/SABS 1200 SPECIFICATIONS

SABS/SANS 1200A – GENERAL

PSA8.3.2.2 Facilities for Contractor

a) Living accommodation

Add the following;

No accommodation is permitted on site. All accommodation must be offsite whether it is rented accommodation or other accommodation.

b) Ablution and latrine facilities

Add the following;

All ablution and latrine facilities supplied and serviced for the duration of the contract shall be water free as no water is available at the designated site camp area and all mobile facilities at the access points. Provision shall be made for both male and female facilities.

c) Tools and equipment

Add the following;

The contractor shall supply a comprehensive list of all tools and equipment to undertake the maintenance work, quality control and testing in Form B3: Schedule of Contractor's Equipment

1. *SABS/SANS 1200AB – ENGINEER'S OFFICE PSAB 3.2 Office buildings*

Amend the following;

The first clause to a floor area of least 16m².

- b) Two tables or desks having a top of size at least 1,5m x 0,9m

Delete h) wash-hand basin

Add the following payment item;

8.3.2.1 aii) Meeting Room

The contractor shall supply a meeting room of at least 6m x 4m with a boardroom table capable of seating at least 10 people and 10 chairs.

3.4.1 Clients H&S Specification**TRANS-CALEDON TUNNEL AUTHORITY:
DELIVERY TUNNEL NORTH****LHWP – 2024 SHUTDOWN****OCCUPATIONAL HEALTH AND SAFETY SPECIFICATION****TABLE OF CONTENTS**

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ATTACHMENT 1: MEASURING INJURY EXPERIENCE

ATTACHMENT 2: A SAMPLE SHE RISK MANAGEMENT REPORT

1. OHS-1 DEFINITIONS

In this document the following expressions shall bear the meanings assigned to them below:

Client means the TCTA (as defined by Construction Regulation 1) for whom construction work is being performed and/or undertaken.

Construction Regulations means the Occupational Health and Safety Act's, No. 85 of 1993, Construction Regulations that came into effect on 07 February 2014.

Occupational health and safety plan means a sufficiently documented plan to the standards of TCTA, which addresses hazards identified and includes safe working procedures to mitigate, reduce or control the hazards identified.

Occupational health and safety specification means a documented specification of all health and safety requirements pertaining to the associated works on a construction site, so as to ensure the health and safety of persons working, visiting, passing, staying and/or working close to the construction site and/or other applicable areas such as site camp.

OHS means the Occupational Health and Safety Act, No. 85 of 1993, as amended and its Regulations.

Engineer means TCTA's agent who acts as a representative for a TCTA in providing professional services for the Engineering and Construction Management for the overall work, which shall also include the professional Engineer or professional certified Engineer as referred to in the Construction Regulations who shall also be obliged to carry out as part of the contract, with TCTA, geotechnical field investigations which includes work classified as construction work or excavation work in Construction Regulations 1.

Principal Contractor means an employer, as defined by Section 1 of the OHS Act who performs construction work, i.e. civil, building, electrical or mechanical work, and is appointed by TCTA to be in overall control and management of the construction site and works.

Contractor means an employer (as defined in Section 1 of the Occupational Health and Safety Act) who performs construction work and includes Principal Contractors.

Designer means a competent person who:

- Prepares a design;
- Checks, and approves a design; or
- Arranges for a person at work under their control to prepare a design, as defined in the Occupational Health and Safety Act, Construction Regulations.

Construction Work means any work in connection with:

- The construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to a building or any similar structure; or
- The construction, erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer, or water reticulation system; or the moving of earth, clearing of land, the making of excavation, piling or any similar civil engineering structure or type of work.

Construction Work Permit means a document issued in terms of Construction Regulation 3.

Construction vehicle means a vehicle used for means of conveyance for transporting persons or material or both such persons or material, as the case may be, both on and off the construction site for the purposes of performing construction work.

Structure means:

- Any building, steel or reinforced concrete structure (not being a building), railway line or siding, bridge, waterworks, reservoir, pipe or pipeline, cable, sewer, sewage works, fixed vessels, road, drainage works, earthworks, dam, wall, mast, tower, tower crane, bulk mixing plant, pylon, surface

and underground tanks, earth retaining structure or any structure designed to preserve or alter any natural feature, and any other similar structure;

- Any falsework, scaffold or other structure designed or used to provide support or means of access during construction work; or
- Any fixed plant in respect of construction work which includes installation, commissioning, decommissioning, or dismantling and where any construction work involves a risk of a person falling.

Temporary Works means any falsework, formwork, support work, scaffold, shoring, or other temporary structure designed to provide support or means of access during construction.

Medical Certification of Fitness means a certificate in the form of Annexure 3 of the Construction Regulations, valid for one year, issued by an occupational health practitioner, whom shall be registered with the Health Professions Council of South Africa.

Each employee on site shall be in possession of a valid MCF. These surveys will be conducted as per the requirements of the Occupational Health and Safety Act no 85 of 1993 and subsequent amendments, performed by a service provider that will be appointed by the Engineer and be issued in the form of Annexure 3 of the Construction Regulations.

These tests will include a chest X ray where applicable, but will not include psychological assessment to work at heights (SAPFI).

Depending on the outcome of the radiation testing as specified in **OHS-5.51** (Biological Monitoring) in this document, employees might be subjected to blood tests in order to determine and monitor radiation exposure.

Depending on the employee's medical risk profile and designation, additional tests might be required, but as a minimum, the following must be included:

- Baseline audiometric screening test that meets Instruction 171 requirements for quality control purposes. Monitoring audiometry may be done on employees who can produce valid baseline audiograms;
 - Visual screening including, but not limited to depth perception and colour blindness tests for at risk employees;
 - Urine multi drug screens. Employees found to be cannabis positive will have a confirmatory test to exclude possible drug interactions. (Employees who are found to be positive will not be allowed on site);
 - Full Occupational History;
 - Open circuit lung function testing that meets required SANS Standards; and
 - Physical examination by a registered Occupational Health Practitioner.
- Drivers and operators must meet SASOM requirements for fitness to drive / operate a LDV / machine and be certified by a registered Occupational Medical Practitioner. Gamma GT blood tests will be done on all drivers and operators at the pre-placement medical, these costs are for the Contractor.
- Employees working at heights will be in possession of the SAPFI psychological assessment to work at height certificate as recognised by the Department of Employment and Labour.

A medical certificate of fitness may be issued, where certain conditions as specified by the occupational health / medical practitioner, are required to be met before an employee is permitted to work or where certain activities have been precluded either temporarily or permanently. Contractors shall provide a documented process for managing those employees who are issued with a certificate of fitness with restrictions.

Employees who are in possession of a valid Chest X ray performed within 4 months of the commencement of the project will not have to undergo a repeat X ray but must be able to produce the films on examination.

Medical Surveillance will be repeated on an annual basis on all site employees or at greater frequencies as determined by assessed risk and hazards exposure. The Occupational Medical Practitioner will be responsible for the submission of all records to the relevant Governmental Department/s on an annual basis.

The cost of these medical surveillance programmes will be for the Contractor and should include biological monitoring for identified heavy metals and radiation levels, once the project is underway.

All site employees will require an exit medical certificate prior to leaving site, copies of the exit certificates to be retained in the Contractors' health and safety file.

Mobile Plant means machinery, appliances or other similar devices that is able to move independently, for the purpose of performing construction work on the construction site.

Occupational Hygiene means the anticipation, recognition, evaluation, and control of conditions arising in / or from the workplace, which may cause illness or adverse health effects to persons (including, but not limited to – noise, vibration, dust, HCS, ventilation, etc.).

Reportable Incidents means all incidents as described under Section 24 and Section 25 of the Occupational Health and Safety Act No 85 of 1993.

Lost Time Incident means all lost time incidents will include the following:

- Fracture
- Where a person is booked off for a full shift (excluding the day of incident)
- Operations and hospitalisation
- Light duty

Light duty means all incidents where the injured person cannot resume the position that he / she was appointed for. This will also be classified as a Lost Time Incident.

2. OHS-2 ABBREVIATIONS

AIA – Approved Inspection Authority.

CLO – Community Liaison Officer.

COP – Code of Practice.

CR – Construction Regulation.

CV – Curriculum Vitae.

HCS – Hazardous Chemical Substances.

HIV – Human Immunodeficiency Virus.

H&S – Health and Safety.

H&S Rep – Health and Safety Representative.

IOD – Incident On-Duty.

JSA – Job Safety Analyses.

LDV – Light Duty Vehicle.

MCF – Medical Certificate of Fitness.

MML – Maximum Mass Load.

MSDS – Material Safety Data Sheets.

NCR – Non-Conformance Report.

OHS – Occupational Health and Safety.

PC – Principal Contractor.

PPE – Personal Protective Equipment.

PTO – Planned Task Observation.

PTW – Permit to work.

SACPCMP – South African Council for Project and Construction Management Professions.

SANS – South African National Standards.

SASOM – South African Society of Occupational Medicine.

SWP – Safe Work Procedure.

TCTA – Trans-Caledon Tunnel Authority.

TMP – Traffic Management Plan.

3. OHS-3 INTRODUCTION

In terms of Construction Regulation 5 (1) (a) and (b) of the **OHS Act**, TCTA is required to compile baseline risk assessment and a suitable, sufficiently documented, and coherent site-specific occupational health and safety specification for any intended project and provide such specification to prospective tenderers / bidders.

In terms of Construction Regulation 5 (5) TCTA appoints an Agent to act on its behalf in fulfilling its health and safety obligations during the engineering and construction stages of the project.

The Agent will manage the health and safety on the construction project on behalf of TCTA and must be registered with The South African Council for the Project and Construction Management Professions (SACPCMP) before 07 August 2015.

This specification has as objective to ensure that the Contractor entering into a contract with TCTA for the services, ensures that construction work is undertaken in accordance with the **OHS Act** and Construction Regulations, as further elaborated in these specifications.

Where this specification refers to “the Act” it shall be taken to mean the **OHS Act** and the respective Regulations under the Act.

This document defines roles, obligations, and duties for the Contractor regarding health and safety on the entire project. Please take note that in the case where sub-Contractors are appointed the same requirements as for Contractors will be applicable. The Principal Contractor will take overall responsibility for the Contractor and all appointed sub-Contractors.

Compliance with this document does not absolve the Contractor from complying with any other minimum legal requirements and the Contractor remains responsible for the health and safety of his employees, those of his mandataries as well as any persons coming on site or on adjacent properties as far as it relates to the construction activities.

In addition to the above, the Contractor shall ensure Safety, Health and Environment are integrated with each other within the Safety, Health, and Environment Plan.

4. OHS-4 SCOPE

The occupational health and safety obligation by the Contractor on this project entails preparing a health and safety plan based on the specification herein included and the OHS Act for field work or similar work which falls under the definition of such as included in Construction Regulation 1.

TCTA will evaluate the health and safety plan to ensure compliance with Construction Regulation 5 that stipulates that TCTA may only appoint a Contractor who has the necessary competencies and resources to carry out the work appointed for safely.

5. OHS-5 GENERAL OCCUPATIONAL HEALTH AND SAFETY PROVISIONS

6. OHS-5.1 Health and Safety Aspects of Designs

Designer’s Responsibilities

The designer of a structure must:

- Ensure that the applicable safety standards incorporated in the Construction Regulations under section 44 of the Act are complied with in the design;

- Take the TCTA's Health and Safety Specification into consideration;
- Inform the Client and its Engineer in writing of any known and anticipated dangers or hazards relating to the construction work, and make available all relevant information required for the safe execution of the work upon being designed or when the design is subsequently altered;
- Refrain from including anything in the design of the structure necessitating the use of dangerous procedures or materials hazardous to the health and safety of persons, which can be avoided by modifying the design or by substituting materials;
- Take into account the hazards relating to any subsequent maintenance of the relevant structure and must make provision in the design for that work to be performed to minimise the risk; and
- The designer of temporary works must ensure that:
 - All temporary works are adequately designed so that it will be capable of supporting all anticipated vertical and lateral loads that may be applied;
 - The design of temporary works is done with close reference to the structural design drawings issued by the contractor, and in the event of any uncertainty consult the contractor;
 - All drawings and calculations pertaining to the design of temporary works are kept at the office of the temporary works designer and are made available on request by an inspector; and
 - The loads caused by temporary works and any imposed loads are clearly indicated in the design.

Hazard Analysis Process

The Contractor shall study the complete construction requirements for ensuring a healthy and safe working environment with particular emphasis on OHS as applicable. He shall address any climatic influences and external and internal influences affecting construction activities such as quarry operations and construction processes. The outcome of the hazard identification process shall be included in the risk assessment and identification of the project.

The process shall be undertaken at every incidence of design change taking into consideration previous observations during the hazard identification process.

Health and Safety during Construction

The Contractor shall provide an appropriate level of expertise and the frequency of inspections to ensure compliance regarding the Construction Regulations and other obligations as required by the OHS. Processes shall be placed to ensure that the design intent, specifications, drawings and general contractual requirements are being met to ensure all his general obligations with particular regard to health and safety including the provision of adequate personal protective clothing, the maintenance of a safe working environment and adequate means of evacuation and treatment in emergencies.

The Designer will carry out inspections during construction to ensure compliance with the design and to stop any construction work that is not in accordance with the design. The Designer will also during his or her final inspection of the completed structure in accordance with the National Building Regulations, include the health and safety aspects of the structure as far as reasonably practicable, declare the structure safe for use, and issue a completion certificate to the TCTA and a copy thereof to the contractor.

7. OHS-5.2 Hazard Identification and Risk Assessment (Construction Regulation 9)

This section shall apply to all cases where the Contractor undertakes, as a deliverable under the contract, work classified in Construction Regulation 1 as Construction Work including geotechnical field investigations.

Development of Risk Assessments

The contractor shall ensure that a method statement *and task-based* risk assessments is developed for all physical work to be performed on site. Method statements shall be compiled by technical staff/supervisors/manager not safety staff.

Every Contractor performing construction work, shall before the commencement of any construction work or work associated with the aforesaid construction work and during such work, ensure that risk assessments are undertaken by a competent person, appointed in writing, and the risk assessments shall form part of the occupational health and safety plan and be implemented and maintained as contemplated in Construction Regulation 7 (1) (a).

The risk assessments shall include:

- The identification of the current as well as emerging risks and hazards to which persons may be exposed to;
- The analysis and evaluation of the risks and hazards identified;
- A documented plan of safe working procedures (SWP) and any method statements to mitigate, reduce or control the risks and hazards that have been identified;
- A plan to monitor the application of the SWPs; and
- A plan to review the risk assessments as the work progresses and changes are introduced, or incidents occurred which requires the re-evaluation of the processes/risk mitigation.

Based on the risk assessments, the Contractor must develop a set of site-specific occupational health and safety rules that will be applied to regulate the occupational health and safety aspects of the construction. These rules will not replace the already identified rules in this specification.

Review of Risk Assessments

The Engineer is to review the hazards identified, the risk assessments and the SWPs at each production planning and progress report meeting as the contract work develops and progresses and each time changes are made to the designs, plans and construction methods and/or processes.

Should an incident occur the SWPs, and all other applicable processes shall be re-evaluated to ensure that the mitigation measures are still applicable and appropriate and if not a revision of the risk assessments, shall be undertaken.

The Contractor will provide the Engineer and all other concerned or affected parties with copies of any changes, *alterations*, or amendments as soon as possible but within 14 calendar days of such changes.

The Contractor will review and approve all his sub-contractor's risk assessments prior to the commencement of the related activities.

Baseline Risk Assessment

In addition to the *task-based* risk assessments the Contractor is required to develop a *baseline risk assessment* specific to their scope of work. The *baseline risk assessment* shall identify the main activities planned, the associated hazard, risks and control measures that the contractor will implement. The baseline risk assessment informs all *task-based* risk assessments and must be updated with any change in construction methodology or design changes.

The baseline risk assessments, together with the site-specific occupational health and safety rules, must be submitted to the Engineer before mobilisation on site commences.

The PC will compile a baseline risk assessment. The Engineer will assist the Contractor on the finalisation of the baseline risk assessment. The PC baseline risk assessment will be based on a 5-point methodology, identifying the following:

- Risk rating before any controls;

- Current control measure;
- Any additional risk mitigation measures required (Risk mitigation plan);
- Risk rating after control measure;
- Risk assessment team members;
- This risk assessment will include all health risks; and
- The risk assessment will be approved by the Client, prior to any work commencing.

When compiling the baseline risk assessment the contractor shall take the following into account (specific to the construction site):

- Veld fires;
- Working in areas with shallow water table, rivers, and wetlands;
- Dust;
- Existing operational infrastructure i.e. water storage or supply systems;
- Security;
- Wildlife, endangered plant species;
- Uneven or unstable structures and/or land;
- Rain;
- Sunburn;
- Deep excavations on confined space;
- Public gathering at entrance gate looking for employment and business opportunities, and
- Riots

All identified control measures from the baseline risk assessment needs to be implemented prior to work commencing.

8. OHS-5.3 Legal Requirements

All Contractors entering into a contract with TCTA shall, as a minimum, comply with the:

- OHS Act and a current, up-to-date copy of the OHS Act and its Regulations must be available on site at all times;
- Compensation for Occupational Injuries and Diseases Act, No. 130 of 1993 (COIDA) as amended. The Contractor will be required to submit a letter of registration and “good standing” from the Compensation Commissioner or compensation insurer before being awarded the contract. The letter of good standing must be current at all times during the contract. The Principal Contractor shall be responsible for ensuring that all sub-contractors comply and that all persons on the project are covered by Compensation Insurance. This will include the registration of any Joint Ventures and use of Labour Brokers; and
- A current, up-to-date copy of the COIDA must be available on site at all times.

9. OHS-5.4 Structure and Responsibilities

10. OHS-5.4.1 Overall supervision and responsibility for occupational health and safety:

- The Contractor appointed in terms of Construction Regulation 5(1) (k) is responsible to implement and maintain the occupational health and safety plan approved by the Engineer, and ensure implementation of plans submitted by Contractors on the Project.
- The Construction Manager and Assistant Construction Manager(s) appointed in terms of Construction Regulation 8(1) and 8(2) are responsible for managing the construction work and shall ensure that all work undertaken complies with the requirements of the OHS Act, its Regulations and these specifications.
- The construction manager shall be dedicated to the specific project and based full-time on site. In his absence an alternate must be appointed.

11. OHS-5.4.2 Operational responsibilities for occupational health and safety.

In carrying out his duties the Contractor shall appoint designated competent employees and/or other competent persons as required by the Act.

The Contractor shall make the necessary appointments during construction. This list below shows the minimum requirements and is therefore not exhaustive.

Appointment description	Appointment required in terms of
Assistant construction manager	Construction Regulation 8(2)
Blasting supervisor	Explosives Regulation 12 and Construction Regulation 13(2)(k)
Bulk mixing plant supervisor	Construction Regulation 20
Bulk mixing plant operator	Construction Regulation 20
Confined space supervisor	General Safety Regulation 5
Construction vehicle, mobile plant and machinery supervisor	Construction Regulation 23
Construction welfare facilities supervisor	Construction Regulation 30
Construction work supervisor	Construction Regulation 8(7)
Demolition work supervisor	Construction Regulation 14(1)
Drivers of construction vehicles and operators of plant	Construction Regulation 23
Electrical installation and appliances inspector	Construction Regulation 24
Emergency, security, and fire coordinator	Construction Regulation 29
Excavation supervisor (including piling)	Construction Regulation 13
Fall protection plan developer	Construction Regulation 10
Fall protection supervisor	Construction Regulation 10
First-aiders	General Safety Regulation 3
Fire-fighting equipment inspector	Construction Regulation 29
Hazardous chemical substances supervisor	Construction Regulation 25 and Hazardous Chemicals Substances Regulations 10
Housekeeping supervisor	Construction Regulation 27
Incident investigator	General Administrative Regulation 9
Ladder inspector	General Safety Regulation 13(a)
Lifting activity supervisor/ Master rigger	Driven Machinery Regulations
Lifting machines and equipment inspector	Construction Regulation 22 and Driven Machinery Regulation 18
Occupational health and safety committee member	OHSA Section 19
Occupational health and safety officer	Construction Regulation 8(5)
Occupational health and safety representatives	OHSA Section 17
Person responsible for machinery	General Machinery Regulation 2
Portable electrical equipment inspector	Electrical Machinery Regulation 9
Rigger	Driven Machinery Regulations
Risk assessor	Construction Regulation 9(1)
Scaffolding supervisor	Construction Regulation 16
Scaffolding inspector	Construction Regulation 16
Scaffolding erector	Construction Regulation 16
Stacking and storage supervisor	Construction Regulation 28 and General Safety Regulation 8(1)
Structures supervisor	Construction Regulation 11
Subordinate construction work supervisor	Construction Regulation 8(8)
Suspended platform supervisor	Construction Regulation 17(1)
Suspended platform inspector	Construction Regulation 17(8)(a)
Suspended platform performance tester	Construction Regulation 17(8)(c)(c)
Temporary works designer	Construction Regulation 12(1)

Appointment description	Appointment required in terms of
Temporary works supervisor	Construction Regulation 12(2)
Traffic safety officer	OHSA Section 9(1)
Vessels under pressure supervisor	Vessels under Pressure Regulations
Welding supervisor	General Safety Regulations 9
Working on, over or next to water supervisor	Construction Regulation 26

These appointments must be in writing and the responsibilities clearly stated together with the period for which each appointment is made. This information must be communicated to and agreed with the appointees.

Copies of appointments must be submitted to the Engineer together with concise CVs of the appointees as part of the Contractor's health and safety plan and if appointed, copies of the appointments included in the occupational health and safety file. All appointments must be approved by the Engineer and any changes of appointees or appointments must be communicated to the Engineer and agreed upon before being implemented.

The Contractor must, provide an organogram of all sub-Contractors that he/she has appointed or intends to appoint and keep this list updated on a weekly basis.

12. OHS-5.4.3 Designation of occupational health and safety representatives (Section 18 of the OHSA)

Where the Contractor employs more than 20 persons (including the employees of sub-Contractors and its supervisors) he shall appoint one occupational health and safety representative for every 20 employees or part thereof. General Administrative Regulation 6 requires that the election, appointment and subsequent designation of the occupational health and safety representatives be executed in consultation with employee representatives or employees. (Section 17 of the OHSA as well as General Administrative Regulation 6 and 7 refer).

Occupational health and safety representatives shall be designated in writing and the designation must include the area of responsibility of the person and term of the designation, as well as the time frame for which he/she is appointed.

13. OHS-5.4.4 Duties and functions of the occupational health and safety representatives (Section 19 of the OHSA)

The Contractor must ensure that the designated occupational health and safety representatives conduct a weekly inspection of their respective areas of responsibility, using a checklist, and report thereon to the Engineer.

Occupational health and safety representatives must be included in accident and/or incident investigations.

Occupational health and safety representatives must attend all occupational health and safety committee meetings.

14. OHS-5.4.5 Appointment of occupational health and safety committee (Section 20 of the OHSA)

The Contractor must establish an occupational health and safety committee consisting of all the designated occupational health and safety representatives, *management*, and a representative of TCTA who shall act as the chairperson without voting rights. The members of the occupational health and safety committee must be appointed in writing and copies of the appointments included in the occupational health and safety file. The number of management representatives may not be more than the number of health and safety representative.

The occupational health and safety committee must meet as a minimum on a weekly basis and consider, at least, the following agenda items:

- Opening and welcome;
- Members present, apologies and absent;
- Minutes of previous meeting;
- Matters arising from the previous meeting;
- Planned tasks for the coming week;
- New machinery / equipment on site;
- Occupational health and safety representatives' reports;
- Incident and/or accident reports and investigations;
- Incident, accident and/or injury statistics;
- Other matters;
- Endorsement of registers and other statutory documents by a duly authorised representative of the Contractor; and
- Close and next meeting.

15. OHS-5.5 Mandatories

The Contractor shall comply with the relevant sections of the Construction Regulations when he appoints sub-contractors, and each sub-contractor must have an approved health and safety file onsite.

16. OHS-5.6 Administrative Controls and the Occupational Health and Safety File

17. OHS-5.6.1 The occupational health and safety file (Construction Regulation 7(1)(b))

As required by Construction Regulation 7(1)(b), the Contractor and other Contractors will each keep an occupational health and safety file on site containing the following documents as a minimum:

- Notification of construction work (Construction Regulation 4);
- Updated copies of the OHS Act and its Regulations as well as the COID Act (General Administrative Regulation 4);
- Proof of registration and good standing with the Compensation Commissioner or a COID Insurer (Construction Regulation 5(1)(j));
- Occupational health and safety plan agreed with TCTA including the underpinning risk assessment(s) and method statements (Construction regulation 7(1)(a))
- Copies of occupational health and safety committee meetings and other relevant minutes;
- Designs and/or drawings [Construction Regulation 7(1)(e)] where applicable;
- A list of Contractors (sub-Contractors) including copies of the agreements between the parties, proof of good standing with the Compensation Commissioner or COID Insurer, and the type of work to be undertaken by each Contractor (Construction Regulation 7);
- Appointment and designation forms as per the site organogram;
- The following registers:
 - Accident and/or incident register (Attachment 1 of the General Administrative Regulations);
 - Access control registers;
 - Internal site access registers (to confirm safe access ways are ensured on a daily basis);
 - Occupational health and safety representatives' inspection register;
 - Construction vehicles and mobile plant inspections by controller;
 - Confined space access control register;
 - Daily inspections of vehicles, plant and other equipment by the operator, driver and/or user;
 - Designer's inspections and structures record;
 - Inspection and maintenance of explosive powered tools;
 - Inspection of electrical installations (including inspection of portable electrical tools, electrical equipment, and other electrical appliances);
 - Excavation inspection registers;
 - Hand tool inspection registers;
 - Fall protection inspections;
 - First-aid box content;
 - Record of first-aid treatment;

- Fire equipment inspections and maintenance;
- Record of hazardous chemical substances kept and used on site;
- Ladder inspections;
- Machine safety inspections (including machine guards, lockouts etc.);
- Inspection registers and logbooks for lifting machines and –tackle (including daily inspections by drivers/operators);
- Master Lifting Machines and Equipment Register (showing all calibration, load test and inspection dates and expiry dates);
- Inspections of scaffolding;
- Inspections of stacking and storage;
- Inspections of structures;
- Temporary works inspection registers;
- Vessels under pressure inspections;
- Pneumatic tools inspection registers;
- Inspections of gas cutting equipment; and
- Inspections of welding equipment.
- All other applicable records;
- Signed contract with the Client;
- Site organogram specifying H&S responsibilities;
- CV's and competencies of all H&S responsible personnel;
- Medical certificates of fitness for all personnel on site;
- Exit certificates for all employees leaving site;
- LDV, Machinery and equipment pre-site inspections approved by the Engineer;
- Weekly H&S Meeting minutes;
- Client H&S meeting minutes;
- Weekly Man-hours Worked;
- Incident Register and incident investigation reports;
- Monthly audit reports;
- Planned Task Observations;
- Job Safety Analyses;
- Pre-use inspection check lists;
- Machinery, LDV and equipment maintenance schedule;
- Baseline Risk Assessment and activity specific risk assessments;
- Proof of all site training (Site induction training, Visitor's induction training, manual handling training etc.);
- Daily alcohol testing results;
- Copies of first aider's certificates minimum level two; and
- Proof of safe disposal of HCS (e.g. fluorescent lights, asbestos etc.).

TCTA will conduct an evaluation of the Contractor's occupational health and safety file on a monthly basis during the monthly OHS audits.

18. OHS-5.7 Occupational Health and Safety Goals and Objectives and Arrangements for Monitoring and Review of Occupational Health and Safety Performance

The Client upholds a principle of "Zero Injury" on projects it implements. The Contractor shall aim to achieve the maximum results from measures implemented on all work fronts of the Project. The Contractor is required to maintain Recordable Case Rate statistics on the project and report on a monthly basis (**See Attachment 3**).

19. OHS-5.8 Notification of Construction Work (Construction Regulation 4)

Where a Construction Permit is required, the Clients Appointed Construction Health and Safety Agent will facilitate the process to obtain the permit, the Principal Contractor will cooperate with the Agent and provide all requested information required for the permit application to the Agent.

Where no work permit is required, the Principal Contractor must notify the Department of Employment and Labour of the construction work and provide the client with proof that such notification has been sent.

20. OHS-5.9 Training, Awareness and Competence

The contents and syllabus of all training required by the OHSA and Regulations must be included in the Contractor's occupational health and safety plan.

21. OHS-5.9.1 General Induction Training

All members of the Contractor's site management as well as all the persons appointed as responsible for occupational health and safety in terms of the Construction and other Regulations will be required to attend a general induction session.

All employees of the Principal Contractor and other Contractors must be in possession of proof of general induction training.

All subsequent and newly appointed employees must also be subjected to the induction training as soon as possible after the appointment but prior to starting to work on site.

22. OHS-5.9.2 Site Specific Induction Training

The Contractor will be required to develop a project specific induction training course based on the risk assessments for the work on this Contract and train all employees and other Contractors on these aspects.

All employees of the Principal Contractor and other Contractors must be in possession of proof that they have attended a site-specific occupational health and safety induction training at all times.

The PC will be responsible to develop site specific induction training, which will also include, but not limited to the following information:

- Approved Traffic Management Plan;
 - Approved Baseline Risk Assessment;
 - Manual Handling Training;
 - Codes of Practices / Safe Work Procedures;
 - Fall Protection Plan;
 - Reporting of Injuries on Duty;
 - Possible health hazards to which they may be exposed and the prevention thereof;
 - Site specific rules;
 - Code of conduct on site;
 - Planned Task Observations; and
 - Job Safety Analyses.
- The training content will be approved by the Engineer prior to presentation. Record of this training will be kept in the site Health and Safety file. The PC will also be responsible to ensure that no person is allowed on site, without the induction training.

23. OHS-5.9.3 Visitors Induction Training

The PC will be responsible for the development and presentation of visitor's induction, which will be approved by the Engineer prior to presentation. This induction presentation will include, but are not limited to the following:

- Site requirements for visitors;
- PPE required;
- Guide;
- No go areas;
- Reporting of hazards and risks;
- Man and machine interaction; and

- Hazards on site with the identified control measures.

No visitor will be allowed to be on site without a permanent guide, who will be a permanent site employee. Visitors will be uniquely identified.

24. OHS-5.9.4 Other Training

- All operators, drivers and users of construction vehicles, mobile plant and other equipment must be in possession of valid proof of training and competency.
- All employees in jobs requiring training in terms of the OHSA and Regulations must be in possession of valid proof of training.
- Occupational health and safety training requirements (as required by the Construction Regulations and as indicated by this occupational health and safety specification and the risk assessment(s)), i.e.:
 - General induction (Section 8 of the OHSA);
 - Site and job specific induction, including visitors (Sections 8 and 9 of the OHSA);
 - Site and project manager;
 - Construction supervisor;
 - Occupational health and safety representatives (Section 18 (3) of the OHSA);
 - Training of the appointees;
 - Operators and drivers of construction vehicles and mobile plant (Construction Regulation 23);
 - Basic fire prevention and protection (Environmental Regulations 9 and Construction Regulation 29);
 - Basic first aid (General Safety Regulations 3);
 - Storekeeping methods and safe stacking (Construction Regulation 28); and
 - Emergency, security, and fire coordinator.

25. OHS-5.9.5 Awareness and Promotion

The Contractor is required to encourage promotion and awareness programmes to create an occupational health and safety culture within project employees. The following are some of the methods that may be used:

- Toolbox talks;
- Posters;
- Videos;
- Competitions;
- Suggestion schemes; and
- Participative activities such as employee “occupational health and safety circles”.

26. OHS-5.9.6 Notices and Signs

The following notices and signs shall, where applicable, be compulsory on the construction site as well as the Contractors’ yards.

Area and/or activity where notice or sign is required	Notice or sign required in terms of
Entry	General Safety Regulation 2C(2)
First-aid	General Safety Regulation 3(6)
Toilets and change rooms	Facilities Regulation 2 (5) 4(2)(f)
Storage of flammable materials	General Safety Regulation 4(8)(a)(i) and (ii) (10(e) only applicable to Contractor’s yards)
Scaffold	SANS 10085-1: 2004
Grinding wheels	Driven Machinery Regulation 8(1)(7)
Machinery	General Machinery Regulation 9 (Schedule D)
Explosive powered tools	Construction Regulation 21(2)(f)
Prohibition on smoking and eating or drinking at	Facilities Regulation 6(b)

Area and/or activity where notice or sign is required	Notice or sign required in terms of
the workplaces where high risk substances (FR5 (1)) are stored or handled	
Non-potable water	Facilities Regulation 7(B)
Excavation work	Construction Regulation 13(2)(l)

*All signage must comply with the requirements of SANS 1186

27. OHS-5.9.7 Competence

The Contractor shall ensure that his and other Contractors' employees appointed, are competent and that all training required to undertake the work safely and without risk to health and safety of their or the health and safety of other persons, has been successfully completed before work commences.

The Contractor shall ensure that follow-up and refresher training is conducted on a regular basis and as the contract work progresses.

Records of all training must be kept on the occupational health and safety file for auditing purposes.

28. OHS-5.9.8 Drugs and Alcohol Use

The Client has a zero-tolerance policy with regards to drugs and alcohol use. The PC will be responsible to conduct daily alcohol testing on each employee on site. Visitors will also be tested prior to going on site. A record of daily testing results will be kept in the H&S file on site. In the case where any person is found to be tested positive for alcohol, the site Engineer and H&S Officer will be informed immediately. Employees who test positive on the handheld breathalyser will be retested after twenty minutes on a machine that is able to give a digital reading, should the reading be over zero again, this person will be escorted off site or taken home.

Although drug testing forms part of the medical surveillance, the PC will be responsible to perform a multi drug test on all employees on site at least once every three months. Records of these tests will be kept in the H&S File on site. No person will be allowed on site or to remain on site if they are found to be tested positive for drugs. These tests will be conducted by the Client appointed Occupational Health Service Provider.

The PC shall identify, implement, and maintain a process for the management of drug and alcohol use for visitors, employees, suppliers and sub-Contractors which will comply with the Labour Relations Act Section 8. All Client representatives on site will also be seen as site employees.

29. OHS-5.10 Consultation, Communication and Liaison

The following arrangements will apply:

- Occupational health and safety liaison between the Engineer, TCTA the Contractor, and other Contractors, the designer and other concerned parties will be through the occupational health and safety committee. In the absence of a health and safety committee, the Engineer and Contractor will agree on an alternative communication forum to be implemented;
- In addition to the above, communication may be directly to the Engineer, verbally (followed up in writing within 14 calendar days) or in writing, as and when the need arises;
- Consultation with the workforce on occupational health and safety matters will be through their supervisors, occupational health and safety representatives, the occupational health and safety committee and their elected trade union representatives, if any;
- The Contractor will be responsible for the dissemination of all relevant occupational health and safety information to the other Contractors, for example design changes, instructions by the Engineer, exchange of information between, the reporting of hazardous and/or dangerous conditions and/or situations, etc;

- The Contractor and the Engineer will be required to do site safety audit with TCTA and / or his Health & Safety Auditor / Agent on a monthly basis;
- The principal and other sub-Contractors will be required to conduct Daily Safe Task Instruction (pre-start team and HS discussion) meetings and a weekly toolbox talks with their employees. Records of these meetings / talks including the topics discussed must be kept on the occupational health and safety file. Employees must acknowledge the receipt of toolbox talks which record must, likewise, be kept on the occupational health and safety file;
- TCTA Health and Safety Auditor and the Contractor will agree on the dates, times and venues of the occupational health and safety meetings;
- The Contractor's health and safety plan will be audited for approval prior to work commencing on site and a letter of approval will be submitted as proof by the Engineer's OHS auditor;
- The Engineer and the PC shall have an H&S meeting at least once per month. The following appointees from the PC will be required to attend the meeting:
 - The PC's Project Manager;
 - The PC's Construction Supervisor;
 - The PC's Resident Engineer (if applicable);
 - The PC's H&S Officer;
 - The Engineer's Project Manager;
 - The Engineer's Resident Engineer;
 - The Engineer's site H&S Officer;
 - The Engineer's H&S Auditor; and
 - The Agent (where applicable).
- Minutes of these meetings will be kept in the H&S File on site. When possible, this meeting can be incorporated into the Site Meeting; and
- The PC shall ensure cooperation and open communication between all sub-Contractors appointed under him. Construction work must also be programmed accordingly to ensure for this.

30. OHS-5.11 Checking, Reporting and Corrective Actions

31. OHS-5.11.1 Monthly Compliance Assessment by TCTA (Construction Regulation 5(1) (o))

Where there is no Clients Health and Safety Agent appointed the Engineer will, on behalf of the client, conduct monthly assessments to confirm that the Contractor has implemented and is maintaining the agreed and approved occupational health and safety plan.

This audit will include all sub-Contractors and will be conducted by the Project Health and Safety Lead. The audit will focus on the legal requirements as well as the requirements as stated in the Contractors Health and Safety Plan. The audit date will be negotiated with the PC beforehand. As a minimum, the following people will be required during the time of the audit:

- PC's H&S Officer
- Sub-contractors H&S Officer (if applicable)
- PC's Project Manager / Construction Manager
- Construction Project Manager

The audit report will be issued within 5 working days after the audit. The PC will have 15 working days to correct all minor NCRs identified in the audit. In the case where a major NCR (non-compliance with legal requirements or issues endangering people) is identified, this specific task will be stopped immediately, until the NCR is corrected and signed off by the Engineer, Auditor or the Construction Project Manager.

Signed off Audit Reports will be filed in the H&S File on site.

32. OHS-5.11.2 Other Assessments and Inspections by TCTA

TCTA reserves the right to conduct other ad-hoc assessments and inspections as deemed necessary. This could include, among others, site safety walks.

33. OHS-5.11.3 Conducting an Assessment

A representative of the Contractor must accompany the Engineer on all assessments and inspections and may conduct his/her own inspection at the same time. Each party will, however, take responsibility for the results of his/her own assessment and/or inspection.

34. OHS-5.11.4 Contractor Assessments and Inspections

The Contractor is to conduct his own internal assessments and inspections to verify compliance with his own occupational health and safety plan and management system as well as the requirements of this specification and the compliance of other Contractors under his/her control. The Contractor must perform monthly OHS Audits on all of his appointed sub-Contractors working on the project.

35. OHS-5.11.5 Inspections by Occupational Health and Safety Representatives and Other Appointees

Occupational health and safety representatives must conduct weekly inspections of their areas of responsibility and report thereon to their foreman or supervisor whilst other appointees must conduct inspections and report thereon as specified in their appointments for example vehicle, plant and machinery drivers, operators and users must conduct daily inspections before start-up. The PC must ensure that all registers and checklists used to perform the required inspections are applicable to the tools, equipment and machinery being inspected. All inspection registers and checklists must be co-signed by the relevant supervisor or safety officer on the required completion intervals to ensure they are informed.

36. OHS-5.11.6 Recording and Review of Inspection Results

All the results of the abovementioned inspections must be in writing, reviewed at occupational health and safety committee meetings, endorsed by the chairperson of the meeting, and placed on the occupational health and safety file.

37. OHS-5.11.7 Reporting of Inspection Results

The Contractor is required to provide the Engineer with a monthly report providing technical progress updates on issues hereof.

The PC will submit, on a weekly basis, as negotiated with the Engineer Site H&S Officer a comprehensive list containing the following:

- Name list of employees on site;
- Hours work per employee per day for the week;
- Visitor hours per day for the week;
- Total man hours worked for the week (including visitors hours);
- Name of each H&S responsible employee;
- Number of PTO's conducted per person per day for the week (as per appointment requirement);
- Number of pre-use inspections conducted per day for the week;
- Number of PC H&S Meetings conducted for the week;
- Number of employees who received site specific induction training;
- Names of employees that resigned, was dismissed from employment or who has absconded;
- Incidents reported for the week, with a description of the incident; and
- Comprehensive list of all vehicles and machinery on site.

38. OHS-5.11.8 Health and Safety Committee

A health and safety committee will be established, and members appointed to serve on the committee prior to work commencing on site. Monthly meetings will be held, and minutes distributed to the Engineer and Client.

Action by the Contractor will be monitored on deviations to effectively implement remedial steps. The frequency of the meetings can be reduced after consultation with the Engineer. Attendance and participation of Senior Site Management is compulsory during these committee meetings.

39. OHS-5.11.9 Site Inspections

Site inspections will be conducted, by the Engineer site H&S Officer on a daily basis. He / she will be accompanied by the PC's H&S Officer. NCRs will be corrected immediately or as soon as reasonably practicable. If an NCR cannot be corrected immediately, the PC's Safety Officer will negotiate with the Engineer H&S Officer on a reasonable time for correction.

These inspections will be recorded and signed off by both H&S Officers, after which these records will be filled in the H&S File on site.

40. OHS-5.12 Incident Reporting and Investigation

41. OHS-5.12.1 Reporting of accidents and incidents (Section 24 and General Administrative Regulation 8 of the OHS)

The Contractor must report all incidents where an employee is injured on duty to the extent that he / she:

- Dies;
- Becomes unconscious;
- Loses a limb or part of a limb; or
- Is injured or becomes ill to such a degree that he / she is likely either to die or to suffer a permanent physical defect or likely to be unable for a period of at least 14 days either to work or continue with the activity for which he / she was usually employed;

or where:

- A major incident occurred;
- The health or safety of any person was endangered;
- Where a dangerous substance was spilled;
- The uncontrolled release of any substance under pressure took place;
- Machinery or any part of machinery fractured or failed resulting in flying, falling or uncontrolled moving objects; or
- Machinery ran out of control.

The reporting will be to the Engineer H&S Officer and Resident Engineer as soon as reasonably practicable, but still in the same shift and to the Provincial Director of the Department of Labour within seven calendar days from date of incident (Section 24 of the OHS and General Administrative Regulation 8), **except** that, where a person has died, has become unconscious for any reason or has lost a limb or part of a limb or may die or suffer a permanent physical defect, the incident must be reported to both the Engineer and the Provincial Director of the Department of Employment and Labour forthwith by telephone, telefax or e-mail. All other reports should still be completed and provided as required.

The Contractor is required to provide the Engineer with copies of all statutory reports required in terms of the OHS within seven calendar days of the incident occurring.

The Contractor is required to provide the Engineer with copies of all internal and external accident/incident investigation reports, including the reports contemplated below, within seven calendar days of the incident occurring.

42. OHS-5.12.2 Accident and incident investigation (General Administrative Regulation 9)

The Contractor is responsible for the investigation of all accidents and / or incidents where employees and non-employees were injured, or could potentially have been injured, to the extent that he, she and / or they had to be referred for medical treatment by a doctor, hospital, or clinic.

The results of the investigation to be entered into the accident and / or incident register.

The Contractor is responsible for the investigation of all minor and non-injury incidents as described in Section 24 (1) (b) and (c) of the OHS and keeping a record of the results of such investigations including the steps taken to prevent similar accidents / incidents in future.

The Contractor is responsible for the investigation of all road traffic accidents, related to the construction activities, and keeping a record of the results of such investigations including the steps taken to prevent similar accidents in future.

The Engineer reserves the right to hold its own investigation into an incident or call for an independent external investigation.

The PC will develop and maintain an incident register that will be kept updated and filed in the H&S File on site. This register will include, but might not be limited to:

- Date;
- Name of person involved;
- Short description of incident;
- Identification no of machine / equipment / vehicle involved (if applicable); and
- Type of incident, which can include, but is not limited to:
 - Fatality;
 - Lost Time;
 - Medical Treatment;
 - Light duty;
 - First Aid Treatment;
 - Near Miss;
 - Hazard;
 - Property Damage;
 - Breakdown; and
 - Environmental

43. OHS-5.12.3 Fatality

The Client has a Zero Harm philosophy. All possible controls will be identified and implemented by the PC in order to ensure that no serious injury occurs. However, in the case where a fatality does occur, the immediate action will be as follows.

The area shall be barricaded, and no unauthorised person shall be allowed in this area. The Police, the Engineer Project Manager and the Engineer site H&S Officer will be informed immediately. Aside from the investigation conducted by the Police, the Engineer will be responsible to conduct an in-house investigation. The Client will be informed by the Engineer as soon as they are informed.

The PC will be responsible to ensure that they retrieve all the information with regards to the deceased and inform the Engineer' Project Manager and site H&S Officer, including, but not limited to:

- Place where body will be taken;
- Names and contact detail of Police officers; and
- Contact detail of family
- The PC will be responsible to inform the family of the incident and will ensure that the body is transported to the place of burial after all legal procedures have been completed.
- The PC shall also be responsible for the report and all applicable documentation to be submitted to Authorities.
- No operations / work will be allowed in the area of the incident, unless authorisation has been given, in writing, by the applicable authorities.

44. OHS-5.12.4 Medical Treatment

In the case of a medical treatment incident, the PC's H&S Officer and / or the Engineer site H&S Officer shall accompany the injured person. These Officers shall ensure that all necessary paperwork is completed and that the injured person is returned to his / her living quarters after receiving medical treatment. If the patient is admitted to hospital, the PC, Engineer site H&S Officer and Construction Project Manager shall be informed immediately.

45. OHS-5.12.5 First Aid Treatment

All first aid incidents will be recorded on the incident register and the Engineer site H&S Officer will be informed immediately.

46. OHS-5.13 Operational Control**47. OHS-5.13.1 Emergency Preparedness, Contingency Planning and Responses**

The performance objectives are: (i) no incidents (no injuries, property damage, environmental, incidents); and (ii) all personnel trained in emergency response procedures.

The Contractor must appoint a competent person to act as emergency controller and/or coordinator.

The Contractor must conduct an emergency identification exercise and establish what emergencies could possibly develop. He/she must then develop detailed contingency plans and emergency procedures, taking into account any emergency plan that TCTA may have in place.

The Contractor and Sub- Contractors must hold regular practice drills of contingency plans and emergency procedures to test them and familiarise employees with them.

48. OHS-5.13.2 First-Aid (General Safety Regulation 3)

The Contractor must provide first-aid equipment (including a stretcher) and have qualified first-aiders on site as required by General Safety Regulation 3 of the OHS Act.

The contingency plan of the Contractor must include arrangements for the rapid and timely transportation of injured and/or ill person(s) to a medical facility or getting emergency medical support to person(s) who may require it.

The Contractor must have firm arrangements with his Contractors in place regarding the responsibility of these Contractor's first-aid arrangements as well as treatment of injured and/or ill employees.

49. OHS-5.14 Occupational Disease

In the case where an occupational disease is identified by the Occupational Health Practitioner, the Occupational Health Practitioner will be responsible to inform the PC, the Engineer site H&S Officer and the applicable authorities. Any referral costs incurred in the confirmation of this diagnosis will be for the PC's account.

50. OHS-5.15 Near Miss / Hazards

All near misses shall be registered on the Incident Register and investigated based on the potential outcome.

Provision should be made to allow any person to report a hazard that has not been addressed in the risk assessment process, a separate hazard register should be maintained.

51. OHS-5.16 Property Damage / Breakdown

- All property damage and breakdown will be registered on the Incident Register, with specific reference to the plant / machine number and the operator. The Engineer site H&S Officer will be informed before the end of the shift.

52. OHS-5.17 Rescue Procedures

No later than 56 days after the commencement date and in any event no later than 7 days before the start of work in any area, the Contractor shall prepare and submit a method statement detailing evacuation procedures for the approval of the Engineer.

The procedures shall detail the nature of the emergencies contemplated, the training of employees forming rescue teams, their numbers, availability (at least one team shall be available for each shift), any delegation of responsibility, liaison with the emergency services and the Engineer, the equipment needed, actual methods of evacuation including transport methods, medical facilities to be used, communications systems to be used and any other matter that the Contractor considers relevant to the subject of emergency evacuation.

The emergencies contemplated shall include, among others, injury, fire, flood, fall of ground, accidental leaks, spillages and explosion and rescue from a confined space.

The equipment requirements shall include the need for items to be used exclusively by the rescue teams, and also the continuous operational readiness of plant and equipment, including standby facilities, during the construction of the works.

The procedures shall cover the level of medical competence of the rescue team, the use of support medical facilities and evacuation off-site to a relevant hospital or otherwise, including the use of helicopter services or the access to air evacuation facilities.

The Contractor shall immediately implement and prominently advertise the procedures in each work area. The Contractor shall test the effectiveness of the rescue procedures under the inspection of the Engineer at least every three months and shall make due allowance in his programs for the testing of the procedures.

53. OHS-5.18 Security

The Contractor must establish site access rules and implement and maintain these throughout the construction period. Access control must, amongst other, include the rule that non-employees will not be allowed on site unaccompanied.

The Contractor must develop a set of project applicable security rules and procedures and maintain these throughout the construction period.

The PC will be responsible for the onsite security as well as the entrance and exit control from site. All vehicles will be inspected once entering or exiting the site. Visitors will sign in all equipment at the gate. Employees on site will be issued with a gate permit for equipment that is taken in and out (e.g. laptops). Each employee on site will be issued with an access card once they have completed the risk-based site medical and Client site induction. The following information will be displayed on the access card:

- Photo of employee (clear black and white / colour);
- Name and Surname of Employee;
- Company;
- Medical completion date;
- Medical restrictions;
- Client induction completion date; and
- Machinery competent to operate.

These cards will be on the person and displayed at all times whilst on site.

The PC will be responsible to ensure that no unauthorised persons visit / enter the construction site. All visitors will be uniquely identified after receiving site specific visitors' induction training. Records of these as well as the hours on site will be retained and available in the Health and Safety file on site. No visitor must be allowed to be on site without a site employee present at all times. Any person who spends less

than 16 hours per week on site, will be classified as a visitor.

54. OHS-5.19 Accommodation of Traffic

Where construction work is undertaken in, next to or close to a public road, the use of appropriate as well as a sufficient number of road signs is of paramount importance to protect employees against traffic and to warn motorists of the presence of construction work as well as construction employees/risks/vehicles.

The Contractor shall ensure that appropriate as well as a sufficient number of road signs are posted to protect employees against traffic and to warn motorists of the presence of construction work as well as construction employees/vehicles. These signs shall be repeated and utilised, where appropriate, as actual construction work is approached.

The following signage is required as a minimum where construction work is undertaken in, next to or close to a public road:

- “Construction work ahead” sign at least 4 m before the start of the construction work;
- “Lane narrows” sign 30m before the start of the construction work;
- “Keep right/left” sign 15m before the start of the construction work and again where the tapering begins; and
- Delineators and cones every 5m for the entire stretch of construction work.

(Traffic accommodation will be in accordance with COLTO 1500 and SADC Road Traffic Signs Manual Volume 2).

Where construction work includes excavations in or next to a public road, warning lights or visible boundary indicators should be provided after dark or when visibility is poor.

The maintenance of all signage and especially those that is suitable after dark should be duly managed.

Where appropriate, duly trained flag persons should be deployed a good distance ahead of areas where traffic is deviated, or lanes closed off. These flag persons should be managed assertively to ensure that they add optimal value, and should they not do so they should be retrained and if necessary, replaced.

The community liaison officer (CLO) should also be sensitised on the optimal management of traffic and the risks involved and then be instructed to increase community awareness through talking to all stakeholders including the distribution of suitable information brochures.

55. OHS-5.20 Fall Protection (Working in elevated positions (Construction Regulation 10))

A pre-emptive risk assessment will be required for any work to be carried out above two metres from the ground or any floor level and will be classified as “work in elevated positions”.

As far as is practicable, any person working in an elevated position will work from a stable platform, ladder or other device that is at least as safe as if he or she is working at ground level and whilst working in this position be wearing a safety harness with a lanyard to prevent the person falling from the platform, ladder or other device utilised. This safety harness will be, as far as is possible, secured to a point away from the edge over which the person might fall and the lanyard must be of such a length and strength that the person will not be able to move over the edge.

Alternatively any platform, slab, deck or surface forming an edge over which a person may fall may be fitted with suitable guard rails at two different heights as prescribed in SANS 10085 code of practice for the design, erection, use and inspection of access scaffolding.

Where the requirement is not practicable, the person will be provided with a full body harness that will be worn and attached above the wearer’s head at all times and the lanyard must be fitted with a shock absorbing device or the person must be attached to a fall arrest system that is approved by TCTA.

Where the requirements are not practicable, a suitable catch net, which must be able to sustain the weight of at least the average person working in the elevated position, must be erected.

Employees working in elevated positions must be trained to do this safely and without risk to their or other person's health and safety.

Updated records confirming the physical and psychological fitness of employees working at elevated positions should be kept on the health and safety file at all times.

The PC is required to develop a Fall Protection Plan which must include:

- A risk assessment of all work carried out from a fall risk position and the procedures and methods used to address all the identified risks;
- The evaluation procedure to be used for assessing employee's medical fitness for working at fall risk positions and the records thereof;
- A training programme for employees working at a fall risk position and the records thereof;
- The procedure on how fall protection equipment will be inspected, tested and maintained; and
- A Rescue Plan.

56. OHS-5.21 Access Scaffolding (Construction Regulation 16)

Access scaffolding must be erected, used, and maintained safely in accordance with Construction Regulation 16 and SANS 10085 entitled, "The Design, Erection, Use and Inspection of Access Scaffolding".

Detailed consideration must be given to all scaffolding to ensure that it is properly planned to meet the working requirements, designed to carry the necessary loadings, and maintained in a sound condition. It must also be ensured that there is sufficient material available to erect the scaffolding properly and safely.

Scaffolding must be erected, altered, or dismantled by person(s) who has/have adequate training and experience in this type of work or under the continuous supervision of such a person.

57. OHS-5.22 Lifting Machinery (Construction Regulation 22 and Driven Machinery Regulation 18)

Lifting equipment must be designed and constructed in accordance with the manufactures / designer's specifications as well as generally accepted technical standards and operated, used, inspected and maintained in accordance with the manufactures requirements as well as that of the Driven Machinery Regulation 18 of the OHSA:

The Driven Machinery Regulation requires that:

- Lifting equipment to be clearly and conspicuously marked with the maximum mass load (MML) that it is designed to carry safely. When the MML varies with the conditions of use, the table of maximum loads should be used by the driver/operator;
- Each winch on a lifting machine must at all time have, at least, three full turns of rope on the drum when the winch has been run to its lowest limit;
- Lifting equipment shall be fitted with a brake or other applicable device capable of holding the MML. This brake or device must automatically prevent the downward movement of the load when the lifting power is interrupted;
- Lifting equipment fitted with a load limiting device that automatically arrest the lift when the load reaches its highest safe position or when the mass of the load is greater than the MML; and
- Every chain or rope on a lifting machine that forms an integral part of the machine must have a factor of safety as prescribed by the manufacturer of the machine and where no standard is available the factor of safety must be:
 - chains – 04 (four)
 - steel wire ropes - 05 (five)
 - fibre ropes- 10 (ten)
- Every hook or load attaching device must be designed as such or fitted with a device that will prevent the load from slipping off or disconnecting;

- Every lifting machine must be inspected and load tested by a competent person every time it has been dismantled and re-erected and every 12 months after that. The load test must be in accordance with the manufacturers prescription or to 110 % of the MML in addition all ropes, chains, hooks or other attaching devices, sheaves, brakes and safety devices forming an integral part of a lifting machine must be inspected every 6 months by a competent person;
- All maintenance, repairs, alterations and inspection results must be recorded in a log book and each lifting machine must have its own log book;
- No person may be lifted by a lifting machine not designed for lifting persons unless in a cradle approved by an inspector of the Department of Labour;
- Tower crane bases are firm, level and secured. Where multiple tower cranes operate with overlapping slewing radii a tower crane operation plan must be developed and all relevant parties trained thereon. Such plan must aim to prevent the risk of slewing loads crossing; and
- The PC shall prepare and maintain an updated lifting machine, tackle and equipment register whereon the dates for load testing and inspections are captured in order to monitor compliance.

58. OHS-5.23 Lifting Tackle

- Manufactured of sound material, well-constructed and free from latent defects;
- Clearly and conspicuously marked with an identity number;
- Maximum mass load factor of safety:
 - Natural fibre ropes - 10 (ten);
 - Man-made fibre ropes and woven webbing - 06 (six);
 - Steel wire ropes – single rope - 06 (six);
 - Steel wire ropes – combination slings - 08 (eight);
 - Mild Steel chains - 05 (five); or
 - High tensile/alloy steel chains - 04 (four);
- Steel wire ropes must be discarded (not used any further for lifting purposes) when wear and corrosion is evident and must be examined by a competent person every three months for this purpose and the results recorded in a designated log book;
- The PC shall prepare and maintain an updated lifting machine, tackle and equipment register whereon the dates for load testing and inspections are captured in order to monitor compliance;
- Lifting tackle to be stored safely when not in use to protect them from getting damaged.

59. OHS-5.24 Construction Vehicle and Mobile Plant Operators (Construction Regulation 23)

The following requirements will apply to construction vehicle and mobile plant operators:

- Only certified and / or competent employees may be allowed to operate any construction vehicle and mobile plant;
- Every lifting machine and mobile equipment operator must be trained specifically for the type of lifting machine or mobile equipment that he or she is operating;
- Operators of jib cranes with a maximum mass load of 500 kg or more must be in possession of a certificate of training issued by an accredited (by the Department of Labour) training provider;
- Only employees duly authorised to do so may operate any construction vehicle and mobile plant; and
- Only employees physically and psychologically fit, i.e. in possession of a medical certificate of fitness, may be allowed to operate any construction vehicle and mobile plant.

60. OHS-5.25 Construction Vehicles and Mobile Plant (Construction Regulation 23)

Construction vehicles and mobile plant must be:

- Of acceptable design and construction;
- Maintained in good working order;
- Used in accordance with their design and intention for which they were designed;
- Operated and/or driven by trained, competent and authorised operators/drivers. No unauthorised persons to be allowed to drive construction vehicles and mobile plant;
- Provided with safe and suitable means of access;
- Fitted with adequate signalling devices to make movement safe including reversing;

- Excavations and other openings must be provided with sufficient barriers to prevent construction vehicles and mobile plant from falling into same;
- Provided with roll-over protection and are fitted with structures designed to protect the operator from falling material;
- Inspected daily before start-up by the driver, operator and/or user and the findings recorded in a register/log book and any defects addressed as matter of urgency;
- Fitted with two head and two tail lights that is in good working condition whilst operating under poor visibility conditions; and
- Fitted with OEM approved seats and seat belts where it is used for transporting people.

No loose tools, material, etc. is allowed in the driver and/or operators compartment/cabin nor in the compartment in which any other persons are transported.

No person may ride on construction vehicles and mobile plant except for in a safe place designed and provided for this purpose.

The construction site must be organised to facilitate the movement of construction vehicles and mobile plant in such a manner that pedestrians and other vehicles are not endangered. Traffic routes to be suitable, sufficient in number and adequately demarcated.

Construction vehicles and mobile plant left unattended after hours adjacent to roads and areas where there is traffic, must be fitted with lights, reflectors or adequate barricades to prevent moving traffic colliding with the parked vehicle or mobile plant,

In addition, construction vehicles and mobile plant left unattended after hours must be parked with all buckets, booms etc. full lowered, the emergency brakes engaged and, where necessary, the wheels chocked, the transmission in neutral and the motor switched off and the ignition key removed and stored safely.

All construction vehicles and mobile plant daily inspection records must be kept available in the relevant vehicle or plant.

61. OHS-5.26 Electrical Installations (Construction Regulation 24)

The installation of temporary electricity for construction use shall be in accordance with Construction Regulation 24 and the Electrical Installation Regulations. The Contractor must ensure that:

- Existing services are to be located and clearly marked before construction commences and during the progress thereof;
- Where the abovementioned is not possible, employees with jackhammers etc. will be protected against electric shock by the use of suitable protective equipment e.g. rubber mats, insulated handles etc.;
- Electrical installations and -machinery are sufficiently robust to withstand normal working conditions on site;
- Temporary electrical installations must be inspected at least once per week by a competent person and a record of the inspections kept on the occupational health and safety file;
- Electrical machinery used on a construction site must be inspected daily before start-up by the competent driver/operator or any other competent person and a record of the inspections kept on the occupational health and safety file; and
- A competent person appointed in writing must control all temporary electrical installations.

62. OHS-5.27 Use and Storage of Flammables (Construction Regulation 25)

The Contractor must ensure that:

- No person is required or permitted to work in a place where there is the danger of fire or an explosion due to flammable vapours being present unless adequate precautions is taken.
- No flammables shall be used or applied e.g. in spray painting, unless in a room or cabinet or other enclosure specially designed and constructed for the purpose, unless there is no danger of fire or explosion due to the application of adequate ventilation.

- The workplace is effectively ventilated. Where this cannot be achieved:
 - Employees must wear suitable respiratory equipment.
 - No smoking or other sources of ignition is allowed in the area.
 - The area is conspicuously demarcated as “flammable.”
- Flammables stored on a construction site are stored in a well-ventilated, reasonably fire-resistant container, cage or room that is kept locked with consistent access control measures in place and sufficient fire fighting equipment installed and fire prevention methods practiced for example proper housekeeping:
 - Flammables stored in a permanent flammable store are stored so that no fire or explosion is caused.
 - Stored in a locked and well-ventilated reasonably fire resistant container, cage or room conspicuously demarcated as “Flammable Store – No Smoking or Naked Lights”.
 - The flammables store to be constructed of two-hour fire retardant walls, door and roof and separated from adjoining rooms or workplaces by means of a two-hour fire retardant fire wall.
 - Adequate and suitable firefighting equipment installed in close vicinity of the flammables store and marked with the prescribed signs.
 - All electrical switches and fittings to be of a flameproof design.
 - Any work done with tools in a flammable store or work areas to be of a non-sparking nature.
 - No Class A combustibles such as paper, cardboard, wood, plastic, straw, etc. to be stored together with flammables.
 - The flammable store to be designed and constructed to, in the event of spillage of liquids in the store, to contain the full quantity + 10 % of the liquids stored.
- A sign indicating the capacity of the store to be displayed on the door.
- Only one day’s quantity of flammable is to be kept in the workplace.
- Containers (including empty containers) to be kept closed to prevent fumes/vapours from escaping and accumulating in low lying areas.
- Metal containers to be bonded to earth whilst decanting to prevent build-up of static forces.
- Welding and other flammable gases to be stored segregated as to the type of gas and empty and full cylinders.

63. OHS-5.28 Housekeeping (Construction Regulation 27)

The Contractor must ensure that:

- Housekeeping is continuously implemented and maintained;
- Materials and equipment is properly stored;
- Scrap, waste and debris is removed off site regularly;
- Materials placed for use are placed safely and not allowed to accumulate or cause obstruction to the free-flow of pedestrians and vehicular traffic;
- Waste and debris not to be removed by throwing from heights but by chute or crane;
- Where practicable, construction sites are fenced off to prevent entry of unauthorised persons;
- Catch platforms or -nets are erected over entry and exit ways or over places where persons are working to prevent them being struck by falling objects;
- An unimpeded work space is maintained for every employee;
- (Every workplace is kept clean, orderly and free of tools and the likes that are not required for the work being done;
- As far as is practicable, every floor, walkway, stair, passage and gangway is kept in good state of repair, skid-free and free of obstruction, waste and materials;
- The walls and roof of every indoor workplace be sound and leak-free; and
- Openings in floors, hatchways, stairways and open sides of floors or buildings are barricaded, fenced, boarded over or provided with protection to prevent persons from falling.

64. OHS-5.29 Stacking and Storage (Construction Regulation 28)

The Contractor must ensure that:

- A competent person is appointed in writing to supervise all stacking and storage on a construction site;
- Adequate areas are provided and demarcated for storage and off-loading;

- The storage areas are kept neat and under control;
- The base of any stack is level and capable of sustaining the weight exerted on it by the stack;
- The items in the lower layers can support the weight exerted by the top layers;
- Cartons and other containers that may become unstable due to wet conditions are kept dry;
- Pallets and containers are in good condition and no material is allowed to spill out;
- The height of any stack does not exceed 3 times the base unless stepped back at least half the depth of a single container at least every fifth tier or the approval of an inspector of the Department of Labour has been obtained to build the stacks higher with the aid of a machine. (The operator of the machine must be protected against items falling from overhead or off the stack and no items may overhang);
- The articles that make up a single tier are consistently of the same size, shape and mass;
- Structures for supporting stacks are structurally sound and able to support the mass of the stack;
- No articles are removed from the bottom of the stack first but from the top tier first;
- Anybody climbing onto a stack can and does do it safely and that the stack is sufficiently stable to support him or her;
- Stacks that are in danger of collapsing are broken down and restacked;
- Stability of stacks is not threatened by vehicles or other moving plant and machinery;
- Stacks are built in a header and stretcher fashion and that corners are securely bonded; and
- Persons climbing onto stacks do not approach unguarded moving machinery or electrical installations.

65. OHS-5.30 Storage of Flammable and Hazardous Chemicals (Hazardous Chemical Substances Regulations)

See paragraphs **OHS-5.27** and **OHS-5.36**.

66. OHS-5.31 Fire Prevention and Protection (Construction Regulation 29)

The PC will be responsible to develop, implement and maintain an effective Fire Prevention and Protection Program. This program will form part of the "Contractors File" to be submitted and approved prior to any work commencing on site.

The Contractor must ensure that:

- Control measures are implemented to prevent fires;
- Sufficient and suitable storage of flammables is provided;
- Sources of ignition are obviated wherever flammable or highly combustible material is present in the workplace, for example:
 - Notices prohibiting smoking is displayed and enforced.
 - Welding and flame cutting is only allowed under controlled conditions that includes written hot work permits and by duly competent persons.
 - Only spark-free hand and power tools are used.
 - No hot work is performed in explosive environments. Flameproof switches and fittings are to be used in the flammable atmosphere.
 - Good housekeeping is maintained to prevent the accumulation of unnecessary combustibles.
 - Adequate ventilation is maintained.
 - Adequate and suitably fixed and portable fire-fighting equipment is provided and maintained in good working order with unrestricted access.
- Maintenance of firefighting equipment must include:
 - Regular inspections by a competent person appointed in writing and records of such inspections should be kept in the occupational health and safety file.
 - Annual inspection and service by an accredited service provider.
- All employees are instructed in the use of the fire-fighting equipment and know how to attempt to extinguish a fire;
- A sufficient number of employees are appointed and trained to act as an emergency team to deal with fires and other emergencies;
- Employees are informed regarding emergency evacuation procedures and escape routes;
- Emergency escape routes are kept clear at all times and clearly marked;

- Evacuation assembly points are demarcated and made known to employees;
- Evacuation is regularly practiced to ensure that all persons are evacuated timeously;
- Roll call is held after evacuation to account for all employees and to ensure that no-one including visitors and disabled persons have been left behind; and
- A clearly audible, to all persons on site, siren or alarm is fitted and regularly tested.

67. OHS-5.32 Eating, Changing, Washing and Toilet Facilities (Construction Regulation 30)

Toilets

The PC shall ensure that proper risk assessments are done in terms of the Hazardous Biological Agents Regulations of the OHS Act and that all employees working in these areas have been adequately vaccinated and are monitored on a regular basis. All necessary supplies will be supplied by the PC as contemplated in the Facilities Regulation of the OHS Act.

The provision of toilets for each sex is required in terms of the National Building Regulations and Construction Regulation 30.

Chemical toilets are allowed instead of the water borne sewerage type. Toilets have to be provided at a ratio of at least 1 toilet per 30 employees within reasonable access.

Showers

At least hot and cold-water showers of some sort for each sex have to be provided at a ratio of at least 1 shower per 15 employees.

Change Rooms

Some form of screened off changing facility must be provided separately for each sex.

Eating Facility

The PC will supply and maintain a sheltered, from the sun, wind and rain, and hygienically clean eating area for employees. There will be sufficient tables and chairs for the employees and means to dispose of uneaten food. The PC will be responsible for ensuring that this area is kept clean and maintained.

Living accommodation

Where the site is in a remote location and transport home is not readily available, reasonable and suitable living accommodation must be provided after obtaining the necessary permission from authorities and adhering to requirements such as Bylaws of the local municipality.

Drinking Water

The PC will be responsible to ensure that sufficient drinking water is available on site at all areas of operation.

The PC will be responsible to ensure that occupational hygiene surveys are conducted in accordance with the baseline risk assessment. The frequency of these surveys will depend on the type of survey, exposure time and possible consequences.

These surveys may only be conducted by an Approved Inspection Authority.

This water must be tested and found compliant with the SANS 241:2009 standard.

The PC to inform their employees which water sources are potable clean drinking water and which are dirty/ unsafe water. The relevant signage needs to be displayed.

Fatigue

A fatigue survey shall be conducted at least once every 2 months on at least 50% of the workforce. The 50% will mainly consist of manual workers and operators. Of the 50%, a maximum of 4% will be

supervisor and management level. These surveys shall be documented and submitted to the Engineer after completion.

The Principal Contractor must provide the methodology as part of their project health and safety management plan.

68. OHS-5.33 Personal and Other Protective Equipment (Sections 8, 15 and 23 of the OHSA)

The Contractor is required to proactively identify the hazards in the workplace and deal with them on an ongoing basis. He/she must either remove them or, where impracticable take steps to protect employees and make it possible for them to work safely and without risk to health under the hazardous conditions.

Personal protective equipment should, however, be the last resort and there should always first be an attempt to apply re-Engineering and other solutions to mitigating hazardous situations before the issuing of personal protective equipment is considered.

Where it is not possible to create an absolutely safe and healthy workplace, the Contractor is required to inform employees regarding this and issue, free of charge, suitable equipment to protect them from any hazards being present and that allows them to work safely and without risk to health in the hazardous environment.

It is a further requirement that the Contractor maintains the equipment, instructs and trains the employees in the use of the equipment and ensures that the prescribed equipment is used by the employee/s in a consistent and correct manner.

Employees do not have the right to refuse to use and/or wear the equipment prescribed by the employer and, if it is impossible for an employee to use or wear prescribed protective equipment through health or any other valid reason, the employee cannot be allowed to continue working under the hazardous condition(s) for which the equipment was prescribed but an alternative solution has to be found that may include relocating the employee.

The Contractor may **not charge any fee** for protective equipment prescribed by him **but may charge for equipment under the following conditions**, following a disciplinary hearing:

- Where the employee requests additional issue in excess of what is prescribed;
- Where the employee has blatantly abused or neglected the equipment leading to early failure; and
- Where the employee has lost the equipment.

As a minimum, the following PPE will be worn by every employee on site:

- Acid resistant overalls
- Hard hat (no graffiti hard hats will be accepted)
- Reflective vests (with zip in front)
- Goggles / Safety glasses
- Safety boots with spats / Gumboots with steel toe cap

Each contractor will ensure that additional PPE requirements are identified as part of their task specific risk assessments. Where additional PPE requirements are identified the contractor shall ensure that the PPE is specified in detail and available for the task to be performed.

69. OHS-5.34 Portable Electrical Tools and Equipment (Electrical Machinery Regulation 9)

Portable electrical tools and equipment includes every unit that takes electrical power from a 15 A plug point and is moved around for use in the workplace i.e. drills, saws, grindstones, portable lights, etc. In addition electrical appliances such as fridges, hotplates, heaters etc. must be inspected regularly but at least on a weekly basis and maintained to the same standards as portable electrical tools and appliances.

The use, inspection and maintenance of portable electrical tools and equipment must be governed by the following:

- Regular inspections by a competent person appointed in writing;
- Inspection results must be recorded in a register;
- Only competent authorised persons are allowed to use portable electrical tools and equipment; and
- The correct protective equipment is worn/used whilst operating portable electrical tools and equipment.

This equipment:

- Must be maintained in good condition at all times to prevent an electrical shock to the user;
- The main source should incorporate an earth leakage protection device or receive power through a double wound transformer or be double insulated and clearly marked as such; and
- All equipment must be fitted with a switch to allow for safe and easy starting and stopping.

70. OHS-5.35 Public Health and Safety (Section 9 of the OHS Act)

The Contractor is responsible for ensuring that non-employees affected by the construction work are made aware of the dangers likely to arise from said construction work as well as the precautionary measures to be observed to avoid or minimise those dangers. This includes among others:

- Non-employees entering the site for whatever reason;
- The surrounding community; and
- Passers-by the site.

Appropriate signage must be posted to this effect and all employees on site must be instructed to ensure that non-employees are protected at all times.

All non-employees entering the site must receive site applicable induction into the hazards and risks and the control measures for these.

71. OHS-5.36 Hazardous Chemical Substances

Hazardous Chemical Substances will be controlled, handled, and stored as per the Hazardous Chemical Substances Regulations under the Occupational Health and Safety Act, No 85 of 1993. Each contractor making use of chemicals shall ensure that:

- The Safety Data Sheet for all chemicals are available and posted in the area where the HCS are stored.
- Use and hazards associated with each chemical is included in the task specific risk assessments and the Safety Data Sheet is attached to the risk assessment.
- No person will be allowed to work or perform a task with a HCS without proper training on:
 - The hazards and risks of the HCS
 - PPE requirements of the HCS
 - First Aid treatment of the HCS, and
 - Proper storage of the HCS
 - Safe disposal of HCS

Additionally each contractor shall ensure that appropriate medical response is available if needed or where a centralised approach is provided ensure that they incorporate this into their processes.

PPE

- The PC will ensure that every person managing or performing a task with the HCS will be issued with the correct PPE as specified in the SDS and / or the baseline risk assessment and JSA.
- PPE will be issued to the employees free of charge.
- Monthly inspections will be conducted, by the PC, on the suitability and general condition of the PPE. In the case where the PPE is no longer suitable for use, the PC will replace it, free of charge.

First Aid

- The PC will ensure that at least one person on the shift / work area is competent in the treatment methods as stated on the SDS for the specific HCS.
- These First Aiders will be in possession of at least a Level 2 First Aid certificate, appointed in writing and uniquely identified.
- A First Aid kit will be available at all storage areas where HCS are stored and work areas where HCS are used.
- The First Aid kit will be managed and stocked as per the General Safety Regulations under the Occupational Health and Safety Act No 85 of 1993.
- The First Aid Kit will include measures to wash out the eyes injured employees and to treat burns.

Fire Prevention

- The PC shall ensure that these HCS are stored in the suitable manner in order not to pose a fire risk.
- Sufficient and effective fire-fighting measure will be instituted.
- Trained and competent Fire Fighters will be appointed in order to operate / initiate these fire-fighting measures effectively.
- A comprehensive "Receive and Issue" list will be maintained by the PC. The list will also include diesel and petrol.

The Contractor must ensure that:

- Employees receive the necessary information and training to be able to use, handle and store hazardous chemical substances safely;
- Employees obey lawful instructions regarding:
 - The wearing and use of personal protective equipment;
 - The use, handling and storage of hazardous chemical substances;
 - The prevention of the release of hazardous chemical substances;
 - The wearing and using of exposure monitoring and measuring equipment;
 - The cleaning up and disposal of materials containing hazardous chemical substances; and
 - Housekeeping, personal hygiene and the protection of the environment.
- The risk assessments required in terms of Construction Regulation 7 include employee exposure to hazardous chemical substances and that the necessary measures be taken to protect persons from being detrimentally affected by hazardous chemical substances present or used in the workplace;
- Suppliers provide the necessary information in the form of safety data sheets regarding hazardous chemical substances required to ensure the safe use, handling and storage of these substances;
- An up-to-date list is kept on site of hazardous chemical substances stored and used together with the safety data sheet of the said hazardous chemical substances;
- Hazardous chemical substance containers be clearly marked as to the contents and main hazardous category e.g. "Flammable" or "Corrosive" and the reference number of the hazardous chemical substances on the list indicated above;
- Where substances are specifically covered in the Regulations under the OHSAct the contractor shall ensure that the requirements of the regulations are implemented in full. i.e. Asbestos and Lead Regulations as example.
- Eating areas are removed from work areas and storage areas for HCS.
- Hazardous chemical substances waste is disposed of safely in terms of hazardous waste disposal requirements.

72. OHS-5.37 Excavations (including Piling) (Construction Regulation 13)

Where excavations or any part thereof will exceed 1, 5 m in depth, the Contractor will be required to submit a method statement which includes a risk assessment to the Engineer for approval before commencing with the excavation and TCTA will issue a permit to proceed once the risk assessment and method statement is approved.

Regardless of the above, all excavation work has to comply with the following:

Excavation work must be carried out under the supervision of a competent person with at least two years practical experience in excavation work who has been appointed in writing.

Before excavation work begins, the stability of the ground must be evaluated.

Whilst excavation work is being performed, the Contractor must take suitable and sufficient steps to prevent any person from being buried or trapped by a fall or dislodgement of material.

No person may be required or permitted to work in an excavation that has not been adequately shored or braced.

Where the excavation is in stable material or where the sides of the excavation are sloped back to at least the maximum angle of repose measured relative to the horizontal plane, shoring or bracing may be left out but only after written permission has been obtained from the appointed competent person.

Shoring and bracing must be designed and constructed to safely support the sides of the excavation and prevent it from collapsing.

Where uncertainty exists regarding the stability of the soil, the opinion of a competent professional Engineer or professional technologist must be obtained, before excavation proceeds, whose opinion will be decisive. The opinion must be in writing and signed by TCTA or technologist as well as the appointed excavator.

No load or material may be placed near the edge of an excavation if it is likely to cause a collapse of the excavation unless suitable shoring has been installed to be able to carry the additional load.

Neighbouring/adjoining buildings, structures or roads that may be affected or endangered by the excavation, must be suitably protected.

Every excavation must be provided with means of access that must be within 6 m of any employee within the excavation at any time.

The location and nature of any existing services such as water, electricity, gas, telecommunication etc. must be established before any excavation is commenced with and any service that may be affected by the excavation, must be protected, and made safe for employees working in or near in the excavation.

Every excavation, including the shoring and bracing or any other method to prevent a possible collapse, must be inspected by the appointed competent person as follows:

- Daily before work commences.
- After every blasting operation.
- After an unexpected collapse of the excavation or part thereof.
- After substantial damage to any support.
- After rain.

The results of any inspections must be recorded in a register kept on site in the health and safety file.

Every excavation accessible to the public or that is adjacent to a public road or thoroughfare or that threatens the safety of persons, must be adequately barricaded or fenced off, on all sides, to at least 1 m high and as close to the excavation perimeter as practicable.

Provided with warning lights or visible boundary indicators after dark or when visibility is poor.

Warning signs to be displayed next to excavations within which or where persons are working.

Upon entering an excavation the requirements of General Safety Regulation 5 must be observed:

- Any confined space may only be entered after the air quality has been tested to ensure that it is safe to breathe and does not contain any flammable or noxious air mixture.
- The confined space must be purged and ventilated of any hazardous or flammable gas, vapour, dust or fumes.

- The safe atmosphere must be maintained.
- Employees are to be provided with breathing apparatus and wearing a safety harness with a rope with the free end of the rope being continuously attended to by a competent person outside the confined space.
- Furthermore, an additional person, trained in resuscitation, to be in full-time attendance immediately outside the confined space.
- Additional serviceable breathing and rescue apparatus is kept immediately outside the confined space for rescue purposes.
- All pipes, ducts, etc. that may leak into the confined space to be blanked off sufficiently to prevent any leakage or seepage.
- The Contractor must ensure that all employees have left the confined space after the completion of work.
- Where flammable gas is present on or in a confined space, no work may be performed in close proximity to the flammable atmosphere that may ignite the flammable gas or vapour.

73. OHS-5.38 Blasting (Explosives Regulations 2003 and Explosives Act, Act 15 of 2003)

The Contractor must ensure that:

- Blasting activities are carried out under the supervision of a competent person with at least five years practical experience in blasting who has been appointed in writing.
- A method statement is developed in accordance with all applicable explosives legislation, by an appointed person, who is certified as a competent person in the use of explosives and provided to the Engineer within three working days prior to blasting taking place.
- The necessary permits are in place for the transportation of explosives to be used.
- Provision has been made for lightning protectors.
- Every lightning protection system is examined and tested by a person with sufficient knowledge, training and experience in lightning protection.
- Access to the blasting area is strictly restricted.
- No smoking or hot work is allowed close to explosives or the blasting areas.
- Reasonable steps are taken to prevent damage to structures in the vicinity of the blasting area.
- Any other industry required safety measures are considered and implemented specifically taking the construction site's specific requirements into account including the removal of any surplus explosives off the site.
- The contractor shall undertake pre-blast inspections at all structures in the vicinity of the blast. Adjacent landowners shall also be notified at least 24 hours in advance prior to each blast.
- Cognisance must also be taken of the possibility of blasted rocks or other loose objects rolling from heights to other areas adjacent to the blast. Relevant mitigation measures to be provided in the Blasting Plan to be submitted for approval.

74. OHS-5.39 Use of Explosives (Explosives Regulations 2003 and Explosives Act, Act 15 of 2003)

The Contractor shall comply with the requirements of the relevant Explosives Act for all requirements involving the use of explosives for the construction of the Works.

In addition to his compliance with the Explosives Act, the Contractor shall submit to the Engineer for approval, a full and detailed Method Statement as to his proposals for the use of explosives in the construction of the Works. This shall be submitted at least 7 days before any blasting work is required, and shall include proposals for:

- The locations of blasting works;
- The location and size of storage magazines, explosives register, security fencing, earthing of building;
- (Danger signs in English, Afrikaans and Zulu that shall be prominently displayed at all areas where explosives are stored or used;
- Transportation of explosives to and from the magazine;
- Licenses required for the magazine(s);
- The storage at the place of use;
- The use of explosives and dealing with misfires;

- The types of explosive and detonators contemplated;
- Ensuring that all excavation spoil is free of undetonated caps;
- Fencing off excavation spoil dumps and preventing unauthorised entry; and
- The names, qualifications and experience of those people responsible for the handling and use of explosives.

In addition to the blasting license referred to in the Explosives Act, the employees who shall be responsible for supervising the charging of drill holes with explosives and the blasting shall have documentary proof that they have at least five years' experience in supervising the loading and firing of charges in surface works such as quarries or underground works such as tunnel excavation, depending on where it is proposed that they shall be employed.

Notwithstanding the provisions of the Explosives Act, any person who is licensed in the storage, handling and in the use of explosives must be literate, of good sight and hearing and well experienced in the work he is to carry out. TCTA shall have the right of access to storage areas and all registers.

Notwithstanding the provisions of the Explosives Act, the Contractor shall:

- Accept a decision of the Engineer to suspend the holder of a blasting certificate for an act of negligence or a contravention of the Explosives Act, as if he, as the 'employer' of the holder of the certificate had made that decision;
- Not permit the underground storage of explosives;
- Keep on site the originals of licenses for his own staff and acknowledged copies of licenses for any subcontracted works. All license holders will carry acknowledged copies on their person when at work. All blasting licenses or certificates should be valid for the period required on site; and
- Install and operate at each point where a blast is to take place, a siren of sufficient volume to be easily heard above the general site noise from all points within a 1 km radius of any blast. Hand operated sirens may only be used in areas of restricted access such as a tunnel heading where access is fully controlled. Sirens will be sounded for at least 5 minutes before any blast takes place and will continue for one minute after the blast has taken place. In addition to the above, the Contractor shall station men on roads and elsewhere with red flags to prevent persons, animals and traffic entering or remaining within the danger zone.

Care shall be taken to ensure that all possible approach routes to the danger zone are covered by these warning arrangements. Blasting shall not be carried out until occupants of any nearby buildings or working areas have been notified by the Contractor at least 24 hours in advance. After blasting, no person shall approach the area until it has been examined by the blasting supervisor or other responsible person and declared safe.

The Contractor shall provide for the approval of the Engineer details of each and every blasting operation at least 24 hours before that operation is to be carried out. The details shall show the location of and the intended time of each blast, the number, size and length of each blast hole, the quantity and types of explosives and detonators to be used and the name of the licensed blaster and shift foreman responsible.

75. OHS-5.40 Working Over or Close to Water

Where construction or other support work is undertaken over or in close proximity to water or similar liquids such as wastewater and sludge, the Contractor shall:

- Appoint a competent person in writing to supervise, control and inspect any work on or over or in close proximity of the water as well as the construction, installation, and dismantling of caissons and/or cofferdams and/or other support or safety structures;
- Ensure that written proof of the competence of above appointee is available on site;
- Ensure that risk assessments are carried out by the competent person before any work is undertaken, mitigation measures documented as well as implemented and thereafter evaluated on a daily basis;
- Undertake the necessary induction and refresher training;

- Ensure that measures for the timeous warning of flooding are in place;
- Ensure that provision is made to prevent employees from falling into the water and the rescuing of employees in danger of drowning;
- Ensure that where an employee is exposed to the risk of drowning by falling into the water, a lifejacket is provided to and worn by the employee; and
- Provide applicable personal protective equipment such as safety harnesses etcetera and enforce the utilisation thereof.

76. OHS-5.41 Suspended Platforms (Construction Regulation 17)

The Contractor shall ensure that all suspended platform work operations are carried out under the supervision of a competent person who has been appointed in writing, and that all suspended platform erectors, operators, and inspectors are competent to carry out their work.

The Contractor shall not use or permit the use of a suspended platform, unless:

- The design, stability and construction thereof comply with the applicable safety standards;
- He or she is in possession of a certificate of system design issued by a professional Engineer, certificated Engineer or a professional technologist for the use of the suspended platform system; and
- He or she is, prior to the commencement of the work, in possession of an operational compliance plan developed by a competent person based on the certificate of system design and applicable to the environment in which the system is being used, this must include proof of the:
 - Competent person who has been appointed for supervision;
 - Competency of erectors, operators, and inspectors;
 - Operational design calculations which should comply with the requirements of the system design certificate;
 - Performance test results;
 - Sketches indicating the completed system with the operational loading capacity of the platform;
 - Procedures for and records of inspections having been carried out; and
 - Procedures for and records of maintenance work having been carried out.

The Contractor making use of a suspended platform system shall forward a copy of the certificate of system design issued by a professional Engineer, certificated Engineer or professional technologist including a copy of the design calculations, sketches, and test results, to the provincial director of the Department of Labour before commencement of the use of the system and must further indicate the intended type of work the system would be used for.

The Contractor shall need not re-submit a copy of the certificate of system design for every new project, provided that the environment in which the system is being used, does not change to such an extent that the system design certificate is no longer applicable and, should uncertainty exist of the applicability of the system design certificate, the decision of a professional Engineer, certificated Engineer or professional technologist will be decisive.

The Contractor shall ensure that the outriggers of each suspended platform:

- Are constructed of steel or any other material of similar strength and have a safety factor of at least four in relation to the load it is to carry; and
- Have suspension points provided with stop devices or other effective devices at the outer ends to prevent the displacement of ropes.

The Contractor shall ensure that:

- The parts of the building or structure on which the outriggers are supported, are checked by means of calculations to ensure that the required safety factor is adhered to without risk of damage to the building or structure;
- The suspension wire rope and the safety wire rope are separately connected to the outrigger;

- Each person on a suspended platform is provided with and wears a safety harness as a fall prevention device which must at all times, be attached to the suspended platform or to the anchorage points on the structure whilst on the suspended platform;
- The hand or power driven machinery to be used for the lifting or lowering of the working platform of a suspended platform is constructed and maintained in such a manner that an uncontrolled movement of the working platform cannot occur;
- The machinery referred to in paragraph (d) is so situated that it is easily accessible for inspection;
- The rope connections to the outriggers are vertically above the connections to the working platform; and
- Where the working platform is suspended by two ropes only, the connections of the ropes to the working platform are of such height above the level of the working platform as to ensure the stability of the working platform.

The Contractor shall ensure that the suspended platform:

- Is suspended as near as possible to the structure to which work is being done and, except when light work is being done, is secured at every working position to prevent horizontal movement between the suspended platform and the structure;
- Is fitted with anchorage points to which employees will attach the lanyards of the safety harnesses worn and used by the employees and such anchorage connections will have sufficient strength to withstand any potential load applied to it; and
- Is fitted with a conspicuous notice easily understandable by all employees working with the suspended platform, showing the maximum mass load which the suspended platform can carry.

The Contractor shall cause:

- The whole installation and all working parts of the suspended platform to be thoroughly examined in accordance with the manufacturer's specification;
- The whole installation to be subjected to a performance test as determined by the standard to which the suspended platform was manufactured;
- The performance test be undertaken by a competent person appointed in writing with the knowledge and experience of erection and maintenance of suspended platforms or similar machinery and who will determine the serviceability of the structures, ropes, machinery and safety devices before they are used, every time suspended platforms are erected; and
- The performance test of the whole installation of the suspended platform to be subjected to a load equal to that prescribed by the manufacturer or, in the absence of such load, to a load of 110 % of the rated mass load, at intervals not exceeding 12 months and in such a manner that every part of the installation is stressed accordingly.

The Contractor shall cause every hoisting rope, hook or other load-attaching device which forms part of the suspended platform to be thoroughly examined in accordance with the manufacturer's specification by the competent person before they are used following every time they are assembled, and, in cases of continuous use, at intervals not exceeding three months.

The Contractor shall ensure that the suspended platform supervisor appointed, or the suspended platform inspector, carries out a daily inspection of all the equipment prior to use, including establishing whether:

- All connection bolts are secure;
- All safety devices are functioning;
- All safety devices are not tampered with or vandalised;
- The maximum mass load of the platform is not exceeded;
- The occupants in the suspended platform are using safety harnesses which have been properly attached;
- There are no visible signs of damage to the equipment; and
- All reported operating problems have been attended to.

The Contractor shall ensure that all inspection and performance test records are kept on the construction site at all times and made available to an inspector, TCTA, TCTA's agent or employee upon request.

The Contractor shall ensure that all employees required to work or to be supported on a suspended platform are:

- Medically fit to work safely in a fall risk position or such similar environment by being in possession of a medical certificate of fitness;
- Competent in conducting work related to suspended platforms safely;
- Trained or had received training which include at least:
 - How to access and egress the suspended platform safely;
 - How to correctly operate the controls and safety devices of the equipment;
 - Information on the dangers related to the misuse of safety devices;
 - Information on the procedures to be followed in the case of:
 - An emergency;
 - The malfunctioning of equipment;
 - The discovery of a suspected defect in the equipment; and
- Instructions on the proper use of safety harnesses.

Where the outrigger is to be moved, the Contractor will ensure that only persons trained and competent to affect such move, perform this task and that an inspection be carried out and the results thereof be recorded by the competent person prior to re-use of the suspended platform.

The Contractor shall ensure that the suspended platform is properly isolated after use at the end of each working day such that no part of the suspended platform will present a danger to any person thereafter.

77. OHS-5.42 Transportation of Employees

Any vehicle used to transport employees must have OEM seats and seat belts firmly secured and adequate for the number of employees to be carried.

The Contractor shall not allow employees to be transported in a goods vehicle.

78. OHS-5.43 Epidemics

In the event of any outbreak of illness of a highly contagious or epidemic nature the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the relevant authorities.

79. OHS-5.44 Lightning

The Contractor shall take precautions against lightning by:

- Implementing a monitoring program using lightning detectors or weather services information.
- Compiling an evacuation process, where needed to remove workers from the work areas to a safe location.
- Identifying and providing safe refuge areas for workers

80. OHS-5.45 Health Measures to Address Industrial Hygiene

The Contractor shall institute and operate a medical screening and examination system for prospective employees. The screening system shall be risk based and must be established in consultation with a registered occupational medical practitioner. No person may be mobilised to site before completing a pre-employment/mobilisation medical performed by a registered medical practitioner, previous medical history and employment examinations must be available to the occupational medical practitioner.

Frequency of surveillance medicals will be determined by the occupational medical practitioner based on the workers exposure and any pre-existing medical conditions.

All workers will be subject to an exit medical examination when demobilised from the project, each contractor shall provide the client with evidence of exit medical for every worker.

Implementation of Industrial Hygiene monitoring program:

The principal contractor shall appoint an Approved Inspection Authority to provide Industrial Hygiene Services to the project. This shall include provision for:

- Occupational Health / Hygiene baseline risk assessment specific to the project
- Implementation of a monitoring program, based on identified hazards. This may include, not limited to:
 - Noise
 - Airborne Particulates, dusts, fumes, gas, mist and vapor
 - Chemical substances
 - Vibration
 - Radiation
 - Illumination
- Provision or practical implementable control recommendations related to exposure measurement results.
- Audit on implementation of control measure recommendations.

The contractor shall additionally establish a primary health care program to assist workers with awareness and support for conditions related to HIV/Aids, Tuberculosis as example.

81. OHS-5.46 Permit to Work

PC's and Contractors shall adhere to the approved Permit to Work (PTW) system of the Client. If the type of work requires it, Contractors shall be trained, competence assessed and authorised in writing, by the Client in order to perform certain duties of an authorised or responsible person. These may include, but are not limited to:

- Operating Regulations or High Voltage systems
- Plant Safety Regulations
- Hot work
- Radiation
- Confined Space Work
- Other.

82. OHS-5.47 Barricading on Site

All barricading on site shall be of the rigged type (orange netting, etc.). Danger tape will not be accepted to serve as barricading.

83. OHS-5.48 Dust Suppression

Dust suppression will take place at intervals determined by the Job Safety Analyses, unless otherwise requested or required by the Engineer site H&S Officer and/or the Engineer Project Manager.

84. OHS-5.49 Minimum Training Requirements for Key H&S Personnel

These training requirements will be the minimum that the PC will have to comply with in order to prove competence of H&S appointees.

Construction Supervisor

- Three years applicable experience in construction management
- Risk Assessment training
- Incident investigation and root cause analyses training
- OHS Act orientation training
- Training in the Construction Regulations
- In-house PTO training
- In-house JSA training

Assistant Construction Supervisor

- Two years applicable experience in construction management
- Risk Assessment training

- Incident investigation and root cause analyses training
- OHS Act orientation training
- Training in the Construction Regulations
- In-house PTO training
- In-house JSA training

Safety Officer

- Five years applicable experience in managing construction H&S
- Risk Assessment training
- Incident investigation and root cause analyses training
- OHS Act orientation training
- Construction Regulation training
- Emergency preparedness and response training
- SAMTRAC / COMSOC
- In-house PTO training
- In-house JSA training
- Safety Officers that will be appointed in terms of the OHS Act / Construction Regulations must be registered and in good standing with the SACPCMP, for work performed in South Africa.

Health and Safety Representatives

- Accredited H&S Representative training
- Hazard identification and risk assessment training
- In-house PTO training
- In-house JSA training

First aiders

All first aiders will be at least an accredited Level 2 first aider, appointed in writing.

The PC will be responsible to develop a method in order to uniquely identify H&S appointed personnel. This method must ensure that these employees are highly visible and all employees on site will be trained on the identification method.

85. OHS-5.50 Identified Hazards on Site

Possible hazards were identified on site, which includes, but are not limited to:

- Veld fires
- Working in areas with shallow water table, rivers, and wetlands
- Dust
- “Live” structures i.e. water storage or supply systems
- Theft
- Wildlife, especially endangered species and snakes
- Uneven or unstable structures and/or land
- Rain
- Mud
- Sunburn
- Deep excavations on confined spaces
- Public gathering at entrance gate looking for employment and business opportunities, and riots

These hazards must be identified in the PC baseline risk assessment, with effective control measures identified. All identified control measures need to be implemented prior to work commencing.

86. OHS-5.51 Biological Monitoring

The Client will be responsible for perform the following tests:

- Chemical analysis of the dust at the Eastern Basin
- Analysis of the ceilings in buildings to be demolished at Eastern Basin

The PC will be informed accordingly and will be responsible to ensure that effective control measures are identified, implemented, and maintained as per the Hazardous Chemical Substances Regulation.

87. OHS-5.52 Traffic Management Plan

The PC will be responsible to compile a Traffic Management Plan (TMP). This plan will as a minimum include the following information:

- Appropriate speed limits
- Travel routes for LDV's
- Travel routes for machinery
- Re-fuelling points
- Parking procedures (safe parking distances/locations and required barriers from heavy mobile equipment and pedestrians)
- Overtaking protocol
- Light vehicles entering hazardous or restricted areas.

This traffic management plan will be approved by the Engineer, prior to any work commencing and then on a monthly basis or as soon as a one of the above mentioned, changes. The traffic management plan will be displayed at key areas in view of all accessing the site. The PC will be responsible for the implementation and compliance with the plan.

The speed limit on site will not be more than 40km/h for machinery and 60km/h for LDV's.

All employees on site will be trained in the effective application of the TMP. Records of such training will be filled in the H&S File on site.

The PC's appointed Traffic Management Supervisor will be responsible for the overall management and approval of the TMP.

88. OHS-5.53 Planned Task Observations

As per the site organogram, a PTO will be conducted by all Supervisory and Managerial personnel. The frequency for Supervisory personnel will be at least one per day. Managerial personnel will perform at least three per week, depending on the complexity and risks on the project. The PC's H&S Officer will perform at least two PTOs per day. The objective of the PTO is to ensure that all staff on site are complying with prescribed requirements and performing their work safely.

All Supervisory and Managerial staff as well as the PC's H&S Officer will be trained in the completion of the PTOs prior to going on site or commencing work.

The format of the PTOs will be approved by the Engineer. If required, the Engineer will issue the PC with an appropriate and acceptable format for PTO's.

89. OHS-5.54 Job Safety Analyses

Training on the effective completion of the Job Safety Analyses (JSA) will be presented to all H&S Representative, Foremen and Supervisors. JSAs shall be conducted prior to any work/task being performed. Where changes in the activity takes place the associated JSA shall be updated. All employees involved in the specific task/operation shall form part of the JSA group and will sign the JSA for attendance, understanding and intent to comply with the control measures as identified on the JSA. The completed JSAs will be submitted to the PC on a weekly basis.

The format of the JSAs will be approved by the Engineer. If required, the Engineer will issue the PC with an appropriate and acceptable format for JSAs.

90. OHS-5.55 Daily Safety Task Instructions and Toolbox Talks

Each supervisor will lead a DSTI at the start of work each day. The DSTI will link to the completed JSA for the activity and the hazards and associated controls for the task to be performed will be discussed with the workers. During the discussion workers must be provided with the opportunity to contribute and ask questions where they not clear on the requirements or add hazards and controls that may not have been identified in the JSA. The supervisor leading the discussion must ensure that each worker in attendance signs off on the DSTI attendance register.

Toolbox Talks will be conducted on a weekly basis with every employee on site and cover more general topics applicable to all workers, not specific to any task. Each contractor will keep a register of topics and attendance.

91. OHS-5.56 Emergency Preparedness and Response

The PC will formulate an emergency response procedure which will deal with both safety and health issues. They will be responsible for ensuring that they establish that the hospitals accept IOD cases and are able to access a private ambulance for the transportation of injured employees.

A designated first aid room will be supplied on each basin, and be, at least, fitted with the following:

- An examination couch
- Desk and chair
- Trauma Board
- Oxygen Cylinder with at least 20 minutes of oxygen
- Hand wash basin
- Air conditioner
- One lockable steel cupboard
- Floors must be tile or vinyl
- Double doors accessible by ambulance

Each employee shall be trained in the process to be followed in the case of an emergency. The PC Site manager and H&S Officer will be in possession of all employees on site's cell phone numbers.

The PC will be responsible to ensure that all employees and visitors on site know and understand the Emergency preparedness and response procedure. Emergency contact card might be a good idea.

Regular emergency drills will be performed on site and the outcome of the drill will be documented and the observations and identified improvements will be filed in the Health and Safety File on site.

92. OHS-5.57 Medical Services

The PC will ensure that there is a qualified Occupational Health Practitioner on site once a week for four hours at the first aid rooms to perform follow up examinations on employees who have restrictions. This service to be negotiated with the Engineer appointed Occupational Health Service Provider.

93. OHS-5.58 First Aiders

First Aiders responsible for the HCS area or use there off, will be trained to at least Level 2.

One First Aider will be appointed for every 50 employees or part thereof, at the work area, or per working group. A First Aider will always form part of a workgroup or work area.

All First Aiders will be appointed in writing and their responsible areas clearly identified. They will also be uniquely identifiable on site.

94. OHS-5.59 First Aid Equipment

A First Aid box will be available at all areas of construction. The content of these First Aid boxes will, as a minimum, contain the contents as required by the General Safety Regulations under the Occupational

Health and Safety Act No 85 of 1993. More first aid boxes shall be provided if the risks, distance between work teams or workplace requirements require it.

The storage and identification will also comply with the requirements of the General Safety Regulations under the Occupational Health and Safety Act No 85 of 1993.

No medication of any kind will be stored in or issued for the first aid kit.

95. OHS-5.60 Emergency Equipment

The PC will ensure that sufficient emergency equipment is available on site. This equipment will be in good working order and inspected at least once a month. The required emergency equipment will be determined by the baseline risk assessment, but will include, as a minimum:

- Life jackets (where required)
- Life buoys (where required)
- Stretchers (full spinal boards with head blocks and spider harness) All first aiders to be trained in its use
- First Aid Kits
- Applicable and effective Fire Extinguishers
- Emergency showers (where required)
- Emergency eye wash facilities (where required)
- Breathing apparatus (where required)

All employees will be trained in the effective use of life jackets, life buoys and fire-fighting equipment. Records of such training will be kept in the H&S File on site.

96. OHS-5.61 Code of Practice / Safe Work Procedure / Method Statement

The PC will be responsible to develop, implement and maintain a Code of Practice (COP) / Safe Work Procedure (SWP) / Method Statement, when inclusive, but not limited to:

- Legislation requires it;
- A task is identified as high risk and/or include exposure to health risks;
- Employees are being trained on a specific task;
- The Auditor/Agent, Engineer site H&S Officer or Construction Project Manager request it;
- Competencies need to be verified by the PC.

97. OHS-5.62 Health and Safety Meetings

98. OHS-5.62.1 PC and the Engineer

The Engineer and the PC shall have a H&S meeting at least once per month. The following appointees from the PC will be required to attend the meeting:

- The PC's Project Manager (Construction Manager)
- The PC's Assistant Construction Manager
- The PC's Construction Supervisor
- The PC's Resident Engineer (if applicable)
- The PC's H&S Officer
- The Engineer's Project Manager
- The Engineer's Resident Engineer
- The Engineer's site H&S Officer
- The Engineer's H&S Auditor
- The Engineer's Occupational Health consultant
- The Agent

Minutes of these meetings will be kept in the H&S File on site. When possible, this meeting can be incorporated into the Site Meeting.

99. OHS-5.62.2 PC and all Sub-Contractors

The PC shall conduct weekly H&S meeting with all his employees as well as all sub-contracting employees. Minutes of these meeting will be filed in the H&S File. The Engineer site H&S Officer has the authority to include any item as a standing item on the minutes.

100. OHS-5.63 Contractor Requirement with Submission of Tender

The PC is responsible to ensure that all contractors and sub-contractors appointed are complying with legal and client requirements. As a minimum, the following documentation must be submitted:

- Letter of Good Standing for the Workmen's Compensation Commissioner or FEM
- Site organogram
- CVs of all key employees or required as identified in site organogram
- H&S statistics for the past 5 years, including:
 - Project name
 - Total project cost
 - Budget for H&S on each project
 - Actual cost for H&S on each project
 - Total hours worked on each project
 - No of incident occurred on each project
 - Reportable incidents (as defined under definitions of this document)
 - Fatalities
 - Lost time (as defined under definitions of this document)
 - Medical treatment (as defined under definitions of this document)
 - First aid (as defined under definitions of this document)
 - Near miss incidents
 - Hazards

All reportable, fatal, and lost time incidents will be discussed in detail.

101. OHS-5.64 Confined Space Work (General Safety Regulation 5)

Upon entering any confined space the requirements of General Safety Regulation 5 must be complied with:

- Any confined space may only be entered after the air quality has been tested to ensure that it is safe to breathe and does not contain any flammable or noxious air mixture.
- The confined space must be purged and ventilated of any hazardous or flammable gas, vapour, dust or fumes.
- A safe atmosphere must be maintained.
- Where a safe atmosphere cannot be maintained employees shall be provided with and trained in the use of self-contained breathing apparatus.
- Each person entering a confined space shall be provided with a safety harness with a rope with the free end of the rope being continuously attended to by a competent person outside the confined space.
- Furthermore, an additional person, trained in resuscitation, to be in full-time attendance immediately outside the confined space.
- Additional serviceable breathing and rescue apparatus is kept immediately outside the confined space for rescue purposes.
- All pipes, ducts, etc. that may leak into the confined space to be blanked off sufficiently to prevent any leakage or seepage.
- The Contractor must ensure that all employees have left the confined space after the completion of work.
- Where flammable gas is present on or in a confined space, no work may be performed in close proximity to the flammable atmosphere that may ignite the flammable gas or vapour.

102. OHS-5.65 Temporary Works (Construction Regulation 12)

All temporary works shall be carried out under the supervision of a competent person who has been appointed in writing for this purpose.

All temporary works must be strong enough to support any loads that may be imposed on them.

The designs of the temporary work must be done with close reference to the design drawings and the designer shall be consulted for any uncertainties. Each temporary works structure must be designed by a competent designer (Construction Regulations).

Detailed activity specific design drawings pertaining to the design of temporary works structures are kept on the site and are available on request to the inspector, other contractors, the Client, the Clients Agent, or any employee.

The temporary works drawings or any other relevant document shall include construction sequences and method statements.

A competent person must inspect all temporary work structures immediately before, during and after the placement of concrete, after inclement weather or any other imposed load and at least on a daily basis until the temporary works structure has been removed and the results have been recorded in a register and made available on site.

Upon casting concrete, the temporary work structure must be left in place until the concrete has acquired sufficient strength to support safely not only its own weight but also any imposed loads, and not removed until authorization has been given by the competent person mentioned above.

The foundation conditions must be suitable to withstand the weight caused by the formwork and support work structure and any imposed loads.

The employees erecting the formwork and support work must be given adequate training and instruction.

All equipment used in temporary works structure are carefully examined and checked for suitability by a competent person, before being used.

103. OHS-5.66 Demolition Work (Construction Regulation 14)

A competent person must be appointed in writing to supervise demolition work

A competent person must carry out a detailed structural engineering survey in order to ascertain the method of demolition to be done and to draw up a method statement prior to commencement of demolition.

During the demolition a competent person shall check the structural integrity of the structure at intervals determined in the method statement mentioned above.

Ascertain as far as possible the location and nature of electricity, water, gas or other similar services, which may be affected by the demolition and the necessary steps to render the circumstances safe for all persons involved.

The contractor shall ensure that no person works under overhanging material or a structure which has not been adequately supported, shored or braced.

The contractor shall ensure where the stability of an adjoining building, structure or road is likely to be affected by the demolition work on a structure that the necessary steps are taken to ensure the stability of such structure or road and the safety of persons.

The contractor shall ensure that no material falls outside the exterior walls of the structure unless that area is adequately protected.

All asbestos related work must be carried out in accordance with the provisions made in the Asbestos Regulations, 2001, promulgated by Government Notice No. R. 155 of 10 February 2002.

All lead related work must be carried out in accordance with the provisions made in the Lead Regulations, 2001, promulgated by Government Notice No. R. 236 of 28 February 2002.

Where explosives are used as part of the demolition work carried out the contractor shall ensure a method statement is developed in accordance with the applicable explosives' legislation, by an appointed person who is competent in the use of explosives for demolition work and all persons involved in the demolition works must adhere to these demolition procedures issued by the competent person.

104. OHS-5.67 Pressure Equipment (Pressure Equipment Regulations)

Competent Person/s with specific knowledge and experience designated to supervise the use, storage, maintenance, statutory inspections and testing of Pressure Equipment. Written proof of competence of above appointee available on Site.

Risk Assessment carried out.

Certificates of manufacture available on site and manufacturer's plate intact.

Register available of all pressure vessels on Site.

Inspections and testing by approved inspection authority (AIA):

- After installation, re-erection or repairs;
- Every 36 months; and
- Register or log kept of inspections, tests, modifications and repair on Site.

Inspection or maintenance schedules should be available for all pressure vessels and such inspections or maintenance to be carried out in accordance with the schedules.

Results recorded and test certificates available.

105. OHS-6 HEALTH AND SAFETY POLICY

The Contractor has to provide the Engineer, as an annexure to the health and safety plan, with a detailed health and safety policy outlining the Contractor's stance on and principles adopted for health and safety, signed, and dated by the Contractor's CEO.

106. OHS-7 COST FOR HEALTH AND SAFETY MEASURES DURING THE CONSTRUCTION PROCESS

The Contractor must demonstrate to the Engineer that sufficient provision has been made for the cost to implement and maintain the health and safety plan proposed to meet the requirements of this health and safety specification as well as that of the OHS and its Regulations.

A detailed schedule of costs must be included as part of the potential contractor's tender document. The successful contractor must provide a project specific health and safety management plan, to be reviewed by the client/clients Agent prior to commencing work. The contractor shall ensure that the health and safety management plan incorporates the requirements of this specification and complies with the requirements of all applicable legislation. The health and safety management plan must provide details on how the contractor will implement, manage, monitor, review and continuously improve while performing work.

107. OHS-8 OVERVIEW OF ATTACHMENTS

Attachment 1: Measuring Injury Experience.

Attachment 2: A Sample SHE Risk Management Report

**ATTACHMENT 1:
MEASURING INJURY EXPERIENCE**

MEASURING INJURY EXPERIENCE

1. Background

Injury experience has moved from measuring injury by the use of a Disabling Injury Frequency Rate, the so-called “DIFR”. The DIFR was calculated by multiplying the number of disabling injuries by 1 million and dividing by the number of person-hours worked.

The DIFR has been replaced internationally with a Recordable Case Rate (RCR). The only difference between the two rates is that the 1 million in the calculation is replaced with 200 000 (200 000 purported to be the number of hours and average person works in a lifetime).

In using of the two rates with manipulation of disabling injuries to hide the facts by returning the injured employee to the workplace so as not to lose a shift and therefore having not to register a disabling injury, will not be tolerated.

This Attachment provides guidance in the use of RCR rate based on the number of compensation injury claims, which are found not to be easy to manipulate because the reporting of injuries, subject to compensation, is a legal requirement.

Measure of the RCR rate shall include professional staff on the project.

2. Recordable Case Rate (RCR)

2.1 Formula

No of Recordable Cases X 200 000

*220 person hours X No of employees

2.2 Definitions

No of compensation claims – The number of recordable cases for the period under review which, while being inclusive shall cover disabling and compensation claims. The Contractor shall keep his own register of cases regardless of their submission for compensation and use for reporting.

200 000 – The fixed factor to align the rate with other rates used internationally.

Person hours worked Include – The denominator of the equation covers the total hours worked on the project to date of the report. The monthly data for the person hours shall be obtained from labour returns kept by the Contractor. Should an alternative calculation method be applicable to obtain hours for the daily paid employees the employee number is multiplied by a common factor of 220 (No of employees X *220 each) for construction workers and (No of employees X *168 hours each) for professional staff.

220 and 168 person-hours – The *average number of hours worked by one construction employee in one month in the construction industry and by one professional in construction industry.

Note: *Overtime, absence on leave or sick leave, unrecorded after hours’ time worked by senior and middle management factored into this average. The total worked hours is always available from the Contractor’s labour data.

No of employees – The actual or average number of employees employed for the period under review.

ATTACHMENT 2:

SAMPLE SHE MANAGEMENT REPORT

SAMPLE SAFETY, HEALTH, AND ENVIRONMENT (SHE): RISK MANAGEMENT REPORT

(Please note that this is an example only and all information is fictitious)

XYZ Construction**SHE Risk Management report for the period January 2004 to March 2004****1. Introduction**

We trust that this quarterly SHE Risk Management report will provide a clear picture of the company's performance as far as occupational health, safety and environment is concerned.

The first quarter of 2004 generally reflected an improvement in injury experience and indicates a decline in the number of injuries. Although Building was the only division where there was an increase in compensation claims, figures are still well down from the average 2003 figures. A sub-Contractor experienced one fatality.

All divisions are eagerly awaiting the final implementation during May 2004 of the new electronic SHE Management system that will provide the tools to implement the SHE programme and make it available to all management and supervisory staff.

2. Incident Statistics**2.1 Recordable Case Rate (RCR)**

See a sample report provided as Attachment 3: **Measuring Injury Experience.**

2.2. Other major incidents

Three other major incidents were experienced in the period under review:

- 2.2.1 A major trench collapsed at Job. 00123: XYZ Head Office, Braamfontein: No personnel injured, extensive damage to foundations: 3 days delay.
- 2.2.2 A concrete dumper ran away when its brakes failed. It smashed into the glass façade of the building on Job 00332: McDonalds, Randburg. The driver jumped off and was not injured. Cost of damage to façade: R45 000.
- 2.2.3 A storage hut on Job 00567: BP Petrol Station, Swartruggens was demolished by fire when the night watchman made a fire inside the storage hut which contained concrete vibrators and levelling machines. Cost of replacing the hut and machines: R30 000.

3. Risk areas

The following items of concern need priority consideration by management:

- 3.1. New employees must undergo pre-employment medical examinations to:
- Protect XYZ from possible claims at a later stage;
 - Ensure that only capable persons are employed;
 - Prevent injuries and illness in the workplace; and
 - Enhance XYZ image.
- 3.2. Vehicle drivers and plant operators must be instructed to inspect their vehicles daily before start-up using the prescribed checklists to ensure that these are safe to operate and in good condition.

4. Risk assessments

Three SHE risk assessments were conducted in February and March:

Job 00432:	Gillooly's Mall	Compliance: 56 %
Job 00786:	Cullinan Head Office	Compliance: 83 %
Job 00589:	Cleveland Station	Compliance: 76 %

5. Training

One hundred and forty two employees, representing 7 % of employees, attended nine training courses. *Our objective is to train 5,5 % of employees on a quarterly basis.

Month	No. of Employees Trained	Course	Source
January	26	Induction	Internal
	15	OH&S Reps	Contractor
	3	Crane Drivers	External
February	23	Induction	Internal
	17	OH&S Reps	Contractor
March	43	Induction	Internal
	9	OH&S Reps	Contractor
	3	Bomag Rollers	Supplier
	3	First Aiders	St. John's

6. Legal matters

- 6.1. An inspector of the Department of Labour issued an improvement notice on Job 00987: Gillooly's Mall. The notice requires that all scaffolding comply with the SANS standards for the Erection and Maintenance of Access Scaffolding (SANS 085). This is currently being attended to and the inspector will return on 15 April 2004 to ascertain if the notice has been complied with.

7. Occupational health matters

7.1 HIV Aids

The proposed clinic will soon be operational, and we will then be able to send our employees who have tested positive for HIV/Aids to the clinic for counselling and eventual treatment when necessary.

The mobile clinic attended to and tested fifty employees on a voluntary basis at 3 sites this month. Eighteen of them tested positive.

7.2 Tuberculosis (TB)

The mobile clinic will be calling at Gillooly's Mall and Cleveland Station on 15 and 16 April 2004 respectively to screen employees for TB.

7.3 Noise

All suspected noise pollution areas have been identified and tested and the results are awaited. Employees working in areas testing over 85dBa will be issued with suitable hearing protectors.

8. Environmental measures

Inspectors from the Botswana Department of Environment visited Djwaneng and inspected the site and yard. They gave it a "clean bill of health" and advised that we should increase the dust control measures by spraying roads three times per day with water instead of the present twice per day.

9. Achievements and awards

- 9.1 The client at Djwaneng (Job 00786) awarded the XYZ site first position in the housekeeping competition conducted bi-monthly by the client's SHE managers. The project manager and his team are to be congratulated for this sterling effort.
- 9.2 Job 0987: Refurbishment of Pretoria Main Railway Station has just completed 1 million compensation claim free days. This was no easy achievement if we consider the conditions being worked under after the extensive fire that caused major damage.

Source: SAFCEC Occupational Health and Safety Committee

3.4.2 Environmental Specification

GENERIC CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

The environmental management requirements set out within this document are generic and must be refined in project specific environmental and health and safety method statements to ensure that the safety of site personnel is assured, and environmental integrity is achieved.

This document may be adapted by TCTA for the purposes of maintenance activity within the tunnel, subject to the refinement of processes and procedures as set out above. It is not appropriate to use this generic Construction Environmental Management Plan (CEMP) for works pertaining to the Ash River.

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Acronyms and Abbreviations

Abbreviation	Definition
CEMP	Construction Environmental Management Plan.
Contractor	The Principal Contractor for infrastructure construction operations, including all sub-contractors appointed by the main contractor of his own volition for the execution of parts of the construction operations; and any other contractor from time to time engaged in connection with any part of the construction operations which is not a nominated sub-contractor to the Principal Contractor.
Contractor's Environmental Office	Contractor's Environmental Officer responsible for ensuring conformance with the CEMP daily.
Corrective Action	It is generally a reactive process used to address problems after they have occurred. Corrective action may be triggered by a variety of events, e.g., Non-conformance.
Emergency	Sudden unforeseen event needing immediate or prompt action.
Environment	Surroundings in which the Contractor operates, including air, water, land, natural resources, flora, fauna, humans and their interrelations.
Environmental Aspect	Element of a Contractor's activities, products or services that can interact with the environment and cause an environmental impact (e.g., dust, noise etc.).
Environmental Impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from a Contractor's activities, products or services.
Environmental Management Plan (EMP)	A plan generated by the Contractor describing the relevant roles and responsibilities and how potential environmental risks will be assessed and managed including the monitoring and recording thereof
Incident/Occurrence	An undesired event occurring at work that results in physical harm to a person or death, or damage to the environment, plant and/or equipment, and/or loss of production.
Non-conformance	An action or situation that does not conform to the Owner's SHEQ standards, procedures or legislative requirement(s) and that can be, or lead to, an unacceptable SHEQ incident.
Project Manager	Means the overall Project Manager responsible for implementation of the Project.
Environmental Manager	Works together with the Project Manager and Construction Manager to ensure that the requirements of the CEMP are met.
Construction Manager	Works together with the Project Manager to ensure that construction proceeds in accordance with the relevant specifications and agreed schedule.
Environmental Officer	Responsible for ensuring that the CEMP is implemented by the Project/construction team and Contractors and their Sub-contractors.

108. Purpose

This document outlines generic environmental management requirements that should be implemented for prior to, and during, site works. The environmental management requirements are generic and must be refined in project specific environmental method statements to ensure that the environment is considered, negative impacts avoided or minimised, and positive impacts enhanced.

109. Roles Responsibilities and Organisational Structure

109.1. Organisational structure

The organisational structure identifies and defines the responsibilities and authority of the various entities involved in the Project. All instructions and official communications regarding environmental matters will follow the organisational structure shown in Figure 0-1.

All instructions that relate to the CEMP will still be given to the Contractor via the Owner's Project Manager. In an emergency, however, the Owner's Environmental Officer may give an instruction directly to the Contractor. Environmental Management of the site will be an item on the agenda of the monthly site meetings, and the Contractor Environmental Officer will attend these meetings. If at any time the Contractor Project Manager is uncertain in any way with respect to an environmentally related issue or any specification in the CEMP, he will consult with the Owner's Environmental Manager.

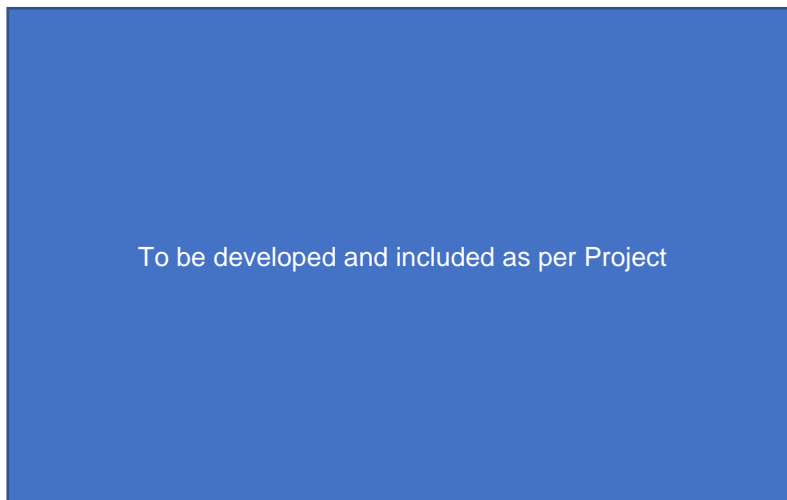


Figure 0-1: Organisational Structure

109.2. The Owner's

109.2.1. *The Owner's Environmental Manager*

The Owner's Environmental Manager will be responsible for ensuring that the CEMP and associated specifications or requirements are complied with during construction.

The specific tasks during the construction stage will include:

- Liaison with the relevant authorities.
- Review all reports from the Environmental Officer, including sign off on Method Statements and Monthly Audit reports.
- Conduct any environmental incident enquiries.

- Identify, with support from the Owner's, the need for corrective or remedial measures about proposed works.
- Ensure induction material includes project appropriate environmental issues.
- Approve training programmes and other awareness initiatives.
- Coordinate or facilitate internal environmental audits.
- Prepare environmental monitoring protocols (if monitoring to be done by Environmental Officer and not by an outside consultant).
- The Owner's Environmental Manager may delegate part or all these responsibilities to the Environmental Officer, based on the merits of the Project at hand.

109.2.2. Construction Manager

The Construction Manager has overall responsibility for environmental management on site which includes the implementation of the CEMP, permits and licenses and reports to the Project Manager. The Construction Manager is supported by the Owner's Environmental Manager.

The specific environmental tasks during the construction phase will include:

- Reviewing the monthly reports compiled by the Contractor Environmental Officer.
- Communicating directly with the Contractors.
- Issuing non-conformance notification to Contractors that do not comply with the requirements of the CEMP and associated requirements or documents.

109.2.3. The Owner's Environmental Officer

The Owner's Environmental Officer reports functionally to the Owner's Environmental Manager and is responsible for conducting the tasks required to ensure that the CEMP including permits and licenses are implemented on the construction site.

The Owner's Environmental Officer will conduct the following tasks:

- Ensure that environmental issues receive adequate attention in the site induction training.
- Prepare and conduct awareness training (e.g. posters, toolbox talks, signage).
- Generate an audit framework/inspection requirement prior to the Project commences for sign off by the Owner's.
- Conduct monthly observation and inspections of all workplaces based on the approved audit framework. Monitor the Contractor's compliance with the CEMP and any permits and licences relevant to the site.
- Develop an Audit finding and close out register that documents all audit findings, close out actions and the time frame allowed for to close the finding/s.
- Ensure that all environmental monitoring programmes (sampling, measuring, recording etc. when specified) are carried out according to protocols and schedules.
- Measurement of completed work (e.g. top soiled areas, re-vegetated, stabilised etc.).
- Maintain site documentation related to environmental management (permits, CEMP, method statements, environmental reports, audits, monitoring results, receipts for waste removal etc.). Documentation to be maintained on the relevant site Document Control System.
- Attendance at scheduled Safety, Health and Environmental (SHE) meetings and project coordination meetings.

- Inspect and report on environmental incidents and check corrective action.
- Keep a regular photographic record of all environmental incidents.
- Implementation of environmental-related actions arising out of the minutes from scheduled meetings.
- Management of site complaints register.
- Review and sign off Method Statements prepared by Contractor's.
- Audit Environmental Method Statements.
- Collate information received, including monitoring results into a monthly report that is supported with photographic records to the Construction Manager showing progress against targets.
- Compile the Project Environmental Management File.
- Report environmental performance of the project monthly.

The key deliverables will include the compilation of:

- Monthly Inspection Checklist.
- Monthly Environmental Audit Report.
- Monitoring Results.
- Incident Reports.
- Environmental Incident Register.
- Environmental Non-Conformance Register and Reports.
- Complaints Register.
- Method Statements Register.
- Hazardous Substances Register.
- Site Close Out Inspection and Report.

109.3. The Contractor

The Contractor will comply with the requirements of the CEMP and abide by the Owner's instructions regarding the implementation of the CEMP.

Section 111 details some of the main actions required from the Contractor at various stages during the project. The Contractor Environmental Officer will monitor that all these actions are undertaken in accordance with the CEMP.

Section 112 contains aspects that will be subject to regular inspections and audits by the various parties.

109.3.1. Contractor's Environmental Officer

The Contractor will appoint an Environmental Officer before commencement of any work on site whose role is to ensure implementation of the CEMP, where applicable.

The Contractor's Environmental Officer will liaise with the Owner's Environmental Officer on site. It will be the responsibility of the Contractor's Environmental Officer to ensure that all work is conducted according to the approved Environmental Method Statements and that the roles and responsibilities as set out in this document are fulfilled. The Contractor's Environmental Officer tasks will include:

- Daily/weekly and monthly inspections of the work area(s) as per schedule or authorise through written instruction by the Owner's Environmental Officer. The Contractor is referred to Section 113 for an example of the items that will need to be inspected and which items will be audited.
- Prepare project-specific activity/aspect based Environmental Method Statements.
- Identify local, provincial and national environmental legislation that applies to the Contractor's activities.
- Monitor conformance with the CEMP and approved Environmental Method Statements.
- Ongoing Environmental Awareness Training of the Contractor's site personnel.
- Reporting, investigating and recording of any environmental incidents caused by the Contractor or due to the Contractor's activities, including their sub-contractors.
- Close out of environmental incidents.
- Attendance at all SHE meetings and induction programmes, and toolbox talks where possible.
- Waste Management.
- Water Management.
- Ensure that environmental signage and barriers are correctly placed.
- Taking required corrective action within specified time frame and close out of non-conformances.
- The Contractor's Environmental Officer will be expected to submit daily/weekly/monthly checklists as agreed by the Owner's Environmental Officer to the Owner's Environmental Officer.
- Should the Contractor's Environmental Officer change from that person identified during either tender stage, or construction period, the Contractor will submit a CV of a replacement Environmental Officer for approval by the Owner's Environmental Officer. No work can proceed until the replacement Environmental Officer has been approved.

110. Matters Pertaining to the Implementation of the CEMP

110.1. Availability of the CEMP

Copies of the CEMP documentation will be available at the site offices of the Contractor and/or on site.

110.2. Environmental Method Statements

Environmental Method Statements are written submissions by the Contractor to the Owner's Environmental Officer describing:

- The proposed activity, setting out the plant, equipment, materials, labour and method the Contractor proposes using to carry out an activity.
- The environmental management of site conditions – waste management, Housekeeping, site establishment.
- Transportation of the equipment to and from site.
- How the equipment/ material will be moved while on site.
- How and where material will be stored.

- The containment (or action to be taken if containment is not possible) of leaks or spills of any liquid or material that may occur.
- Timing and location of activities.
- Description of potential positive and negative environmental impacts and how they will be managed.
- Conformance / non-conformance with the environmental specification and any other statutory and best practice standards.
- Monitoring and reporting requirements.
- Any other information deemed necessary by the Owner's.

The Contractor will compile Activity-/Aspect-based Environmental Method Statements for all activities proposed. The Environmental Method Statements will enable the potential positive and negative environmental impacts associated with the proposed construction activity to be identified and mitigation measures put in place. All method statements must be signed by the Contractor, thereby indicating that the works will be carried out according to the methodology described therein.

Activities may only commence once the Environmental Method Statements have been approved by the Owner's Environmental Officer. In some instances, local authorities may also need to approve the method statements.

All changes to the original Method Statements must be approved by the Owner's Environmental Officer prior to implementation. The Contractor will also be required to re-sign the amended Environmental Method Statement.

To enable timely approvals, the environmental method statements will be submitted to the Owner's Environmental Officer for review two weeks prior to the intended date of commencement of the activity.

Where changes to the work methodology are proposed, Environmental Method Statements must be amended accordingly and signed off by all relevant parties as indicated above. This Environmental Method Statements must contain sufficient information and detail to enable the Construction Manager and the Owner's Environmental Officer to apply their minds to the potential impacts of the works on the environment. The Contractor will also need to thoroughly understand what is required of him/her to undertake the works.

The initial Environmental Method Statements required for submission and approval are listed in the environmental specifications. Others may be requested by the Construction Manager and/or the Owner's Environmental Officer during the Contract.

110.3. Environmental Incidents

In the event of an environmental incident, the Contractor will follow the following procedure:

- Step 1: Immediately take all reasonable measures to contain and minimise the effects of the incident, including its effects on the environment and any risks posed by the incident to the health, safety and property of persons;
- Step 2: Notify the Owner's Environmental Officer in writing including the following information: the nature of the incident and initial classification; substances involved with quantities; initial measures taken to minimise impacts; causes of the incident; measures taken and proposed to avoid the reoccurrence of the incident;
- Step 3: Step 3: Report the incident on all relevant documents and systems - Environmental Incident Register and Environmental Incident Report;

- Step 4: Undertake clean-up procedures;
- Step 5: Remedy the effects of the incident; and
- Step 6: Assess the immediate and long-term effects of the incident on the environment and on public health.

In the event of any Level 1 or 2 environmental incidents, the Contractor's Environmental Officer must complete an Environmental Incident Report and document the incident on the Environmental Incident Register.

In the event of any Level 1, 2 or 3 environmental incidents, the Owner's Environmental Officer will:

Ensure that an Environmental Incident Report has been compiled and that it contains the necessary information; and

Report, record, investigate and analyse the incident and communicate the required action plans to be implemented to the Construction Manager.

In the event of any Level 4 environmental incidents, the Contractor's Environmental Officer must document the incident on the Environmental Incident Register.

In the event of an incident (regardless of level) occurring, the Environmental Officer shall ensure that the problem statement on the report is clear, the actual or potential consequences are noted, and priority mitigation actions and responsibility for actions are indicated where necessary.

An environmental incident is classified under four levels: 1, 2, 3 and 4. They are defined as follows:

110.3.1. Level 1 Environmental Incident

An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in:

- A significant impact on the physical or biological environment (air, ground, water and habitat) with extensive or long-term impairment of ecosystem function or surface and ground water resources.
- An inconvenience/ disturbance/disruption/annoyance (including odour, dust, noise, traffic problem, loss of water supply) of a long duration or with a long-term impact on interested and affected parties. A release of material (gas, liquid, solid) or energy that will cause chronic illness, permanent lost time injury, fatality or extensive property damage experienced by interested and affected parties.
- Irreparable damage to highly valued structures and sacred locations.
- Public or national / international media outcry.
- Instances where inspections undertaken by or for the regulator to check legal compliance, were found to be outside the permitted limits and have resulted in prosecution.
- Where the environmental impact of a Level 2 environmental incident is still present 120 days after occurrence, the incident will be reclassified as a Level 1 incident.

NOTE: A Level 1 environmental incident usually should be reported to the authorities, the incident usually results in significant pollution and may entail risk of public danger. Level 1 environmental incidents usually cause an irreversible impact even with the involvement of long-term external intervention i.e. expertise, best available technology, remedial actions, excessive financial cost etc.

110.3.2. Level 2 Environmental incident

An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in:

- A moderate impact on the physical or biological environment (air, ground, water or habitat) with limited impairment of ecosystem function and/or surface and ground water resources.
- An inconvenience disturbance/ disruption/annoyance (including odour, dust, noise, traffic problems, loss of water supply) of moderate or with medium effect on interested and affected parties.
- A release of material (gas, liquid, solid) or energy that causes severe but reversible illness, non-lost time injury or moderate property damage experienced by interested and affected parties.
- Damage to rare structures of cultural significance or significant infringement of cultural values / sacred locations.
- Attention from local media or widespread complaints.
- Instances where inspections undertaken by or for the regulator to check legal compliance have been outside the permitted limits and an official pre-directive or directive was issued.
- Inability of Contractors to close out corrective actions in an NCR without proper reason.
- Where the environmental impact of a Level 3 environmental incident is still present 3 days after occurrence, the incident will be reclassified as a Level 2 incident.

NOTE: A Level 2 environmental incident may be reported to the authorities, can result in significant pollution or may entail risk of public danger. The impact of Level 2 environmental incidents should be reversible within a short to medium term with or without intervention.

110.3.3. Level 3 Environmental incident

An incident or sequel of incidents, whether immediate or delayed, that results or has the potential to result in:

- A minor impact on the physical or biological environment (air, ground, water or habitat), with no significant or long-term impairment to the ecosystem function or surface/ground water resources.
- An inconvenience / disturbance / disruption / annoyance (including odour, dust, noise, traffic problems, loss of water supply) of short duration and with no long-term effect on the employees and the community.
- A release of material (gas, liquid, solid) or energy that has the potential to cause illness, or that causes short term discomfort or reversible health effect to interested and affected parties.
- Isolated complaints by interested and affected parties.
- Instances where inspections undertaken taken by or for the regulator to check for legal compliance, have been outside the permitted limits and a non-compliance notice was issued.

NOTE: A Level 3 environmental incident is not reportable to authorities, should not result in pollution and may not have a risk of public danger. The impact of Level 3 environmental incidents should be insignificant immediately after occurrence and/or once-off intervention on the day of occurrence.

110.3.4. Level 4 Environmental incident

A minor incident with lesser significance that did not necessarily result in damage or injury but that had the potential to cause damage to the environment, including:

- Could result in service disruption with a lesser significance.
- Did not necessarily result in damage (such as a spill).
- Had the potential, under different circumstances, to cause major damage to the environment.

110.4. Public Complaints

Any public complaints received shall be dealt with as depicted in Figure 0-2.

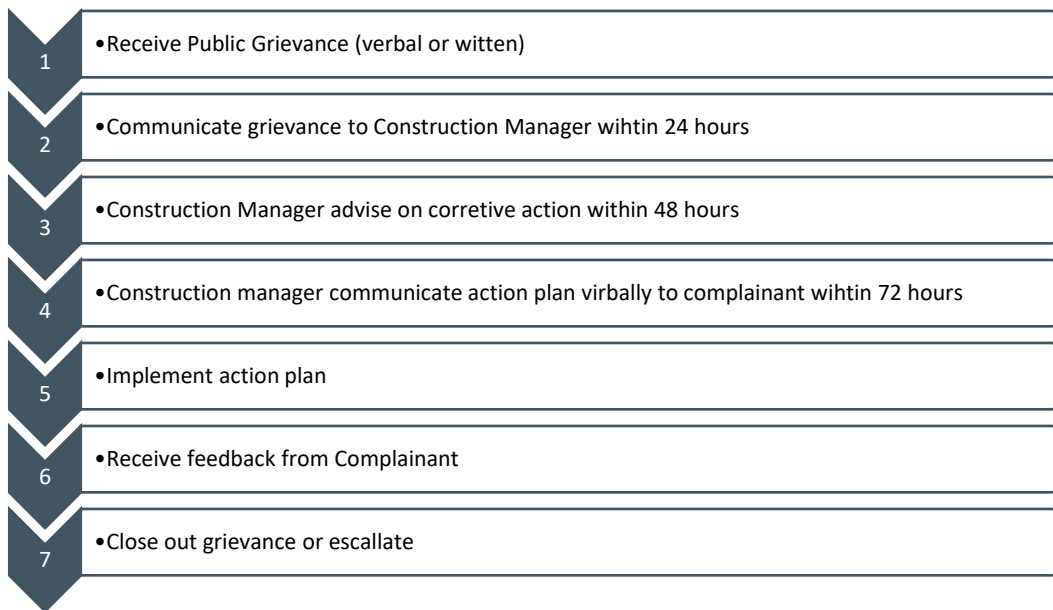


Figure 0-2: Grievance Mechanism

110.5. Environmental Non-Conformances

A non-conformance may be issued to the Contractor by the Owner’s or the Project Manager/Construction Manager/Environmental Officer where:

- The incident response procedure described above (including administrative requirements) was not successfully implemented; or
- There are repeated incidents because of inadequate environmental practices on site;
- Documentation required to comply with the CEMP is not prepared or maintained adequately on site; or
- Any non-compliances with the requirements of the CEMP and Environmental Specifications are identified.

A non-conformance is due to a non-conformance with the Works Information and it is the responsibility of the Contractor to correct the non-conformance to ensure that the work takes place in accordance with the Works Information. Similarly, non-conformance with the CEMP will be regarded as a non-conformance with the Works Information. The Contractor is responsible to rectify any non-conformance as defined above promptly.

The Contractor’s Environmental Officer shall be responsible to search for and identify non-conformances with the environmental specifications at inspection intervals agreed to with the Owner’s Environmental Officer. The Owner’s Environmental Officer shall also undertake such

inspections monthly. If such monthly inspections indicate that any part of the Contractor's work is non-conformant with the requirements of the CEMP, the Owner's Environmental Officer shall complete an Environmental Non-Conformance Report. The Contractor shall correct the non-conformance within the timeframes specified in the report and notification and submit proof of such correction to the Owner's Environmental Officer by virtue of a completed Non-Conformance Report and up to date Non-Conformance Register.

If such non-conformances have not been rectified by the end of Contract date, the Owner's Environmental Officer shall not issue the Contractor with a Site Closure Certificate. In such an event, the Owner's may also make use of any reasonable contractual means to rectify the non-conformance(s) as allowed by the Contract (retention moneys etc.).

110.6. Documentation and Records

The Owner's Environmental Officer will ensure that the Contractor's Environmental Officer is supplied with all required/applicable documents for the Contractors Environmental Management File.

The Contractor's Environmental Officer will complete and maintain copies of all documents and records and ensure that these documents and records are kept up to date.

The Contractor's Environmental Officer will submit these documents to the Owner's Environmental Officer monthly except where documents have remained unchanged in which case written notification to this effect must be provided to the Owner's Environmental Officer.

Once the construction activities have been completed and the Owner's Environmental Officer has conducted a site closure inspection and notified the Contractor that site closure will be granted, all documents described above must be handed over to the Owner's Environmental Officer after which a Site Closure Certificate will be issued.

NOTE: All documents/records are to be retained for a period of 10 years. In the event of environmental documentation/record being lost before receiving a Site Closure Certificate, the Contractor will be penalised according to the specifications laid down in the relevant project-specific contract.

111. Main Actions required by the Contractor to Comply

111.1. Prior to Commencement

The Project Manager must ensure that the requirements below are requested of the Contractor in the Project Construction Contract Document, the Letter of Appointment and any other relevant correspondence with the Contractor prior to the start of works, as relevant.

111.1.1. *Appointment of Contractor's Environmental Officer*

The Contractor will appoint an Environmental Officer or assign to a competent person roles and responsibilities for environmental management during construction. The Contractor will forward details of the appointment to the Construction Manager and the Owner's Environmental Manager for their review and approval.

111.1.2. *Environmental Management Plans and Method Statements*

Where relevant, activity based environmental method statements, will be provided by the Contractor as part of project initiation. These could include, but are not limited to, the following where applicable:

- Establishment of construction lay down area.
- Hazardous and non-hazardous waste management.
- Storm water management.

- Handling, Storage and Management of Hazardous Substances.
- Contaminated water management.
- Prevention of marine pollution.
- Hydrocarbon spills.
- Diesel tanks and refuelling procedures.
- Dust control.
- Spoil dumping.
- Sourcing, excavating, transporting and dumping of fill material.
- Noise and vibration control.
- Removal of rare, endemic or endangered species.
- Removal and stockpiling of topsoil.
- Rodent and pest control.
- Environmental awareness training.
- Site establishment and demarcation.
- Emergency procedures for environmental incidents.
- Closure of construction laydown area.
- Rehabilitation.
- Emergency construction activity Environmental Method Statements may also be required. The activities requiring Environmental Method Statements cannot commence if they have not been approved by the Owner's Environmental Manager or the Owner's Environmental Officer.

111.1.3. Environmental Induction

The Contractor will ensure that all management, foremen and the general workforce, as well as all sub-contractors, suppliers and visitors to site have attended the Owner's Environmental Induction Programme prior to commencing any work on site. Where new personnel commence work on site during the construction period, the Contractor will ensure that these personnel also undergo the Owner's Environmental Induction Programme and are made aware of the environmental specifications on site. The Contractor must ensure that all their personnel understand the requirements of the CEMP as relevant to their scope of work.

111.2. During the Construction Period

111.2.1. Copy of the CEMP and familiarisation thereof

A copy of the CEMP will be available on site and the Contractor will ensure that all the personnel on site (including sub-contractors and their staff) as well as suppliers, are familiar with and understand the specifications contained in these documents.

111.2.2. Site clean-up for Closure

Retention moneys will not be paid until a Site Closure Inspection (conducted by the Owner's Environmental Officer) has taken place and site closure granted and signed off by the Owner's and the Owner's Environmental Manager together with the Site Closure Certificate.

112. Standards for Environmental Management

The Contractor shall identify the potential environmental impacts that may occur because of his/her activities and accordingly prepare separate Method Statements describing how each of these impacts will be prevented or managed so that the standards set out in this document are achieved. These method statements will be prepared in accordance with the requirements set out in the CEMP.

The Contractor will comply with the standards described below.

112.1. Site Planning and Establishment

The Contractor shall establish his construction camps, offices, workshops, staff accommodation and any other facilities on the site in a manner that does not adversely affect the environment. These facilities must not be sited near sensitive area.

112.1.1. Site plan

Before the onset of construction, the Contractor shall submit to the Owner's Environmental Officer for his/her approval, plans of the exact location, extent and construction details of these facilities and the impact mitigation measures the Contractor proposes to put in place.

The Site Plan must as a minimum include but not necessarily be limited to:

- Detailed layout of the construction works areas including access roads, site offices, material laydown areas, temporary stockpile areas and parking areas.
- Detailed locality and layout of all waste storage and handling facilities for litter, kitchen refuse and workshop-derived effluents.
- Proposed areas for the stockpiling of topsoil and excavated spoil material.
- Demarcation of the construction footprint including areas not to be disturbed by the development.
- Location of sewage and sanitary facilities at the site offices and staff accommodation and at all localities on the site where there will be a concentration of labour. Sanitary arrangements should be to the satisfaction of the Owner's.
- The site offices should not be sited near steep areas. It is recommended that the offices, and in particular the ablution facilities, aggregate stockpiles, spoil areas and hazardous material stockpiles be located as far away as possible from any watercourse. Should this not be possible, approval for the location of these facilities must be granted by the Owner's Environmental Officer.

112.1.2. Identification and establishment of suitable access routes/roads

Existing access routes to the construction/works areas must be used as far as possible. The building of access roads must be restricted to within the development footprint to prevent unnecessary disturbance of the surrounding environment. Access tracks must be maintained in a good condition at all times during construction to minimize erosion and dust generation.

112.1.3. Demarcation of site limits

Prior to the commencement of construction, the actual site to be developed must be clearly demarcated by means of highly visible barriers such as fences and orange snow netting. Vegetation within the demarcated zone may be cleared. Disturbance of vegetation outside of the demarcated development footprint is not permitted.

All plant, material and equipment required for construction must be located within the designated areas. Laydown areas must be clearly demarcated within the site limits. No activities are allowed outside of the demarcated development footprint.

112.1.4. Eating Areas

The Contractor is responsible for providing temporary shade areas within the works area to ensure that workers do not leave the site to eat during working hours. Refuse bags must be provided at all established eating areas and when full it should be disposed as required by Section 112.2.

112.1.5. Effluent Management

All effluent water from site shall be disposed of in a properly designed and constructed system, situated so as not to adversely affect water courses (streams, rivers, pans dams etc.). Only domestic type wastewater shall be allowed to enter the designated system.

112.1.6. Sewage and Sanitation

The Contractor is responsible for providing adequate sanitary facilities to all workers on site and for enforcing the proper use of these facilities. Safe and effective sewage treatment will require one of the following sewage handling methods: septic tanks and soak-aways, dry-composting toilets such as "enviro loos", or the use of chemical toilets which are supplied and maintained by a suitably qualified sub-contractor. The type of sewage treatment will depend on the location of the site and the surrounding land uses, the duration of the contract and proximity (availability) of providers of chemical toilets. The waste material generated from these facilities shall be serviced on a regular basis and proof thereof shall be available in the Contractor's Environmental File.

Toilets and latrines shall be easily accessible and shall be positioned within walking distance from wherever employees are employed on the works. Use of open areas (i.e. the veldt) shall not, under any circumstances, be allowed.

Outside toilets shall be provided with locks and doors and shall be secured to prevent them from blowing over. The toilets shall also be placed outside areas susceptible to flooding and high winds. The Contractor shall arrange for regular emptying of toilets and shall be entirely responsible for enforcing their use and for maintaining such facilities in a clean, orderly and hygienic condition to the satisfaction of the Construction Manager.

The Contractor shall ensure that there are separate toilet facilities for male and females on site at a ratio of one facility for every 10 employees.

112.2. Waste Management

Waste is grouped into "general" or "hazardous", depending on its characteristics. The classification determines handling methods and the ultimate disposal of the material.

General waste to be expected during construction includes the following:

- Trash (wastepaper, plastics, cardboard, etc.) and food waste from offices, warehouses and construction personnel.
- Uncontaminated construction debris such as used wood and scrap metal.
- Uncontaminated soil and non-hazardous rubble from excavation or demolition.
- The Contractor shall classify all wastes expected to be generated during the construction period.
- Examples of typical construction waste which could be expected on the site and how they should be classified are indicated in the following table:

Table 0-1: Example of construction Waste Classification

Waste	Classification	
	Hazardous	General
Aerosol containers	X	
Batteries, light bulbs, circuit boards, etc.	X	X
Clean soil		X
Construction debris contaminated by oil or organic compounds	X	
Domestic waste		X
Empty drums (depends on prior use)	X	X
Empty paint and coating containers		X
Explosive waste	X	
PCB waste	X	
Rubble (not contaminated by oil or organic compounds)		X
Waste Cable		X
Waste plastic		X
Waste paint and/or solvent	X	
Waste oil	X	
Waste concrete		X
Waste containing fibrous asbestos	X	
Waste timber		X
Sewerage sludge	X	
Scrap metal		X
Chemically derived sanitary waste	X	

A hierarchical control approach to waste management is encouraged. Waste should preferably be managed in the following order of preference:

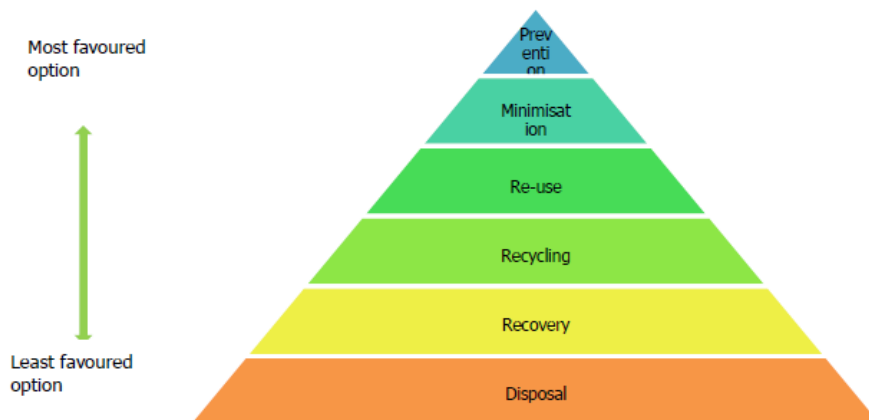


Figure 0-3: The Waste Management Hierarchy

Avoidance/Prevention: using goods in a manner that minimises their waste components.

- Reduction/Minimisation: reduction of the quantity and toxicity of waste generated during construction.
- Re-use: removing an article from a waste stream for use in a similar or different purpose without changing its form or properties.

- Recycling: separating articles from a waste stream and processing them as products or raw materials
- Recovery: reclaiming particular components or materials, or using the waste as a fuel
- Disposal: burial, deposit, discharge, abandoning or release of waste

The Contractor is responsible for the removal of all waste from site generated through the Contractor's activities. The Contractor shall ensure that all waste is removed to appropriate licensed waste management facilities.

The Contractor shall manage hazardous waste anticipated to be generated by his operations as follows:

- Characterise the waste to determine whether general or hazardous.
- Obtain and provide an acceptable container with correct and visible classification label. Place hazardous waste material in allocated container.
- Inspect the container on a regular basis as prescribed by the Contractor's waste management plan.
- Track the accumulation time for the waste. Haul the full container to the disposal site.
- Provide documentary evidence of proper waste disposal of the waste (Waste Disposal Certificate).

The Contractor's Environmental Officer will work in conjunction with the Contractor's construction safety and industrial hygiene personnel to create a Hazardous Materials Management Program. This program will establish the necessary protocol for proper handling and removal of hazardous materials on the site.

The Contractor shall manage general waste that is anticipated to be generated by operations as follows:

- Determine if waste is non-hazardous and obtain containers for waste storage.
- Notify waste hauler when container is full so that it can be removed and replaced with an empty.
- No littering is allowed on site. In the event where staff mobility is high, refuse bags will be made available by the Contractor.
- Provide documentary evidence of proper disposal of waste.

The Contractor shall recycle general waste (as far as practically possible) that is anticipated to be generated by its operations as follows:

- Obtain and label recycling containers for the following (whichever relevant) and locate them within temporary office building and trailers:
 - Office Waste;
 - Aluminium;
 - Steel;
 - Glass;
 - Ferrous Metals;
 - Non-Ferrous Metals; and
 - Waste Timber.

- Establish recycled material collection schedule.
- Arrange for full bins to be hauled away.
- Spent batteries, circuit boards, and bulbs, while non-hazardous, require separate storage, special collection and handling.
- No burning, burying or dumping of waste of any kind will be permitted.
- The Contractor shall quantify all waste disposed of, whether general or hazardous (including waste disposed of by any sub-contractors) and keep record of these quantities on site.

112.3. Workshops, equipment maintenance and storage

All vehicles and equipment must be kept in good working order to maximise efficiency and minimise pollution. Maintenance, including washing and refuelling of plant on site must be done at designated locations at workshop areas. These designated areas must be agreed with the Construction Manager and the Owner's Environmental Officer. The Contractor must ensure that no contamination of soil or vegetation occurs around workshops and plant maintenance facilities. All machinery servicing areas must be bunded. Drip trays should be used to collect used oil, lubricants and other during maintenance. Drip trays must be provided for all stationary plant. Washing of equipment should be restricted to urgent maintenance requirements only. Adequate wastewater collection facilities must be provided.

112.4. Vehicle and Equipment Refuelling

112.4.1. Stationary/Designated Refuelling

No vehicles or machines shall be serviced or refuelled on site except at designated and approved servicing or refuelling locations. No oil or lubricant changes shall be made except at designate locations, or in case of breakdown or emergency repair.

The Contractor shall store fuel and oil at a secure area, which shall be bunded to contain 110% of the total volume within the bund and designed with an impervious layer or liner or paved surface to prevent spillage from entering the ground.

The Contractor shall provide details of its proposed fuel storage and fuelling facility to the Owner's Environmental Officer for approval. The design shall comply with the local environmental legislation and regulations.

112.4.2. Mobile Refuelling

In certain circumstances, the refuelling of vehicles or equipment in a designated area is not a viable/practicable option and refuelling has to be done from a tank, truck or container moved around on site. In such circumstances, the Contractor may request approval from the Construction Manager to conduct mobile refuelling subject to the following control measures:

- Secondary containment equipment shall be in place. This equipment shall be sized to contain the most likely volume of fuel that could be spilt during transfer.
- Absorbent pads or drip trays are to be placed around the fuel inlet prior to dispensing.
- Mobile refuelling units are to be operated by a designated competent person.
- The transfer of fuel must be stopped prior to overflowing. Fuel tanks or refuelling equipment on vehicles may only be filled to 90% carrying capacity.
- Mobile fuelling tanks must be stored in an area where they are not susceptible to collisions. The fuel storage area must be located away from drainage channels.

- Mobile refuelling operations shall not take place within 15 meter of any residential buildings, or 7.5 meter from other structures, property lines, public ways or combustible storage.
- All mobile refuelling tanks are to be properly labelled and fire extinguishers shall be located near the fuel storage areas. These extinguishers must be of a suitable type and size.

112.5. Handling, Storage and Management of Hazardous Substances

All hazardous materials/substances shall be stored in a secured, designated area that is fenced, bunded and has restricted entry.

All storage shall take place using suitable containers to the approval of the Construction Manager and the Owner's Environmental Officer.

All hazardous liquids shall be in a secure, demarcated area and an adequate bund wall (110% of the total volume stored) shall be provided. The floor and wall of the bund area shall be impervious to prevent infiltration of any spilled/leaked liquids into the soil.

No possible spillages or accumulated stormwater within this bunded area will be allowed to be flushed from the bund into the surrounding area. All fluids accumulated within the bunded area shall be removed and disposed of in accordance with Section 112.2.

Hazard signs indicating the nature of the stored materials shall be displayed on the storage facility or containment structure.

Weigh bills of hazardous substances shall be sourced from suppliers and kept on site for inspection by the Owner's Environmental Officer.

The Contractor must provide a method statement detailing the hazardous substances that are to be used during construction, as well as the storage, handling and disposal procedures for each substance. Emergency procedures in the event of misuse or spillage that might negatively affect the environment must be specified.

Information on each hazardous substance will be available to all persons on site in the form of Material Safety Data Sheets (MSDS)/Safety Data Sheets (SDS). Training and education about the proper use, handling, and disposal of the material will be provided to all workers handling the material.

The Contractor's Environmental Officer must be informed of all activities that involve the use of hazardous substances to facilitate prompt response in the event of a spill or release.

112.6. Housekeeping

The Contractor must ensure proper housekeeping of the site for the duration of the Project.

Materials will be stored in a neat and tidy manner in designated areas as per the approved site layout plan.

112.7. Spill Response

The Contractor shall have adequate spill response materials/equipment on site which must be aligned with the volumes of hazardous substances used on site and the risk of pollution to sensitive environmental attributes.

The Contractor shall provide details for approval by Construction Manager and the Owner's Environmental Officer of its spill response plan in the event of any spills of fuel, oils, solvents, paints or other hazardous materials. The plan will show measures to be taken in removing contaminated material from site and demonstrate complete removal of contamination.

The Contractor shall instruct construction personnel on the following spill prevention and containment responsibilities:

- Immediately repair all leaks of hydrocarbons or chemicals .
- Take all reasonable means to prevent spills or leaks.
- Do not allow sumps receiving oil or oily water to overflow.
- Prevent storm water runoff from contamination by leaking or spilled drums of oil or chemicals.
- Do not discharge oil or contaminants into storm water or sewer systems.
- If a spill occurs on land, the Contractor must:
 - Immediately stop or reduce the spill.
 - Contain the spill.
 - Recover the spilled product.
 - Remediate the site.
 - Implement actions necessary to prevent the spill from contaminating groundwater or off-site surface water.
 - Dispose of contaminated material at a location designated thereto and provide proof thereof.
- Any spill to water has the potential to disperse quickly, therefore, the spill must be contained immediately using appropriate containment equipment.
- If a spill to water occurs, the Contractor must:
 - Take immediate action to stop or reduce the spill and contain it.
 - Notify the appropriate on-site authorities.
 - Implement actions necessary to prevent the spread of the contamination by deploying booms and/or absorbent material.
 - Recover the spilled product.
 - Properly dispose of spilled material and provide proof thereof.

112.8. Dust Management

Material in transit should be loaded and contained within the load bin of the vehicle in such a way as to prevent any spillage onto the roads and the creation of dust clouds. If necessary, the load bin of the vehicle shall be covered with a tarpaulin to prevent dust.

Dust is to be controlled on unpaved access roads and site roads using sprayed water.

Contractors are responsible for managing dust generated because of their activities.

Some dust control measures which are normally applied during construction are presented in this section for inclusion by the Contractor in his Dust Control Method Statement:

- Operate vehicles within speed limits, where no speed limit has been specified the limit shall be 20km/h.
- Wash paved surfaces within the construction area twice a week.
- Minimise haulage distances.
- Apply water to gravel roads with a spraying truck when required.

- Environmentally friendly soil stabilisers may be used as additional measures to control dust on gravel roads and construction areas.
- Dust suppression measures will also apply to inactive construction areas. (An inactive construction site is one on which construction will not occur for a month or more).
- Construction material being transported by trucks must be suitably moistened or covered to prevent dust generation.
- Minimise disturbance of natural vegetation during right-of-way construction (e.g. transmission lines and erection of fences) to reduce potential erosion, runoff, and air-borne dust.
- Implement a system of reporting excessive dust conditions by construction personnel (as instructed through Environmental Awareness Training).
- Water used for dust control shall only be taken from approved sources.

112.9. Water Protection and Management

No water shall be abstracted from any water course (stream, river, or dam) without the expressed permission of the Construction Manager and the Owner's Environmental Officer. Such permission shall only be granted once it can be shown that the water is safe for use, that there is sufficient water in the resource to meet the demand, and once permission has been obtained from the Authorities in accordance with the requirements of the National legislation.

Water for human consumption shall be available at the site offices and at other convenient locations on site. The generally acceptable standard is that a supply of drinking water shall be available within 200m of any point on the construction site.

Method Statement(s) must be prepared by the Contractor for the various water uses. The Contractor shall keep record of the quantities of water used during construction (including use by sub-contractors), irrespective of the purpose of use.

112.10. Storm water and Dewatering Management

The Contractor shall be aware that, apart from runoff from overburden emplacements and stockpiles, storm water can also be contaminated from batch plants, workshops, vehicle wash-down pads, etc., and that contaminants during construction may include hydrocarbons from fuels and lubricants, sewerage from employee ablutions and excess fertiliser from rehabilitated areas, etc.

The Contractor shall take note that discharges to controlled waters such as rivers, groundwater or to sewerage systems are controlled under National Legislation. The following specific measures are required:

- Temporary drainage must be established on site during the construction period until permanent drainage is in place. Contractors are responsible for maintaining the temporary drainage in their areas. Contractors must provide secondary drainage that prevents erosion.
- Contractors must employ good housekeeping in their areas to prevent contamination of drainage water.
- The Contractor shall clear stagnant water.
- The Contractor shall ensure that no contaminated surface water flows off-site because of Contractor operations. Silt traps shall be constructed to ensure retention of silt on site and cut-off ditches shall be constructed to ensure no runoff from the site except at points where silt traps are provided. The Contractor shall be responsible for checking and maintaining all silt traps for the duration of the Project.

- If applicable, the Contractor shall be responsible for collection, management, and containment within the site boundaries of all dewatering from all general site preparation activities. The dewatering water shall be contained within the site boundaries by sequentially pumping or routing water to and from sub-areas within the site as the construction activities proceed. No discharge/dewatering to off-site land or surface water bodies will be allowed.
- On-site drainage shall be accomplished through gravity flow. The surface drainage system shall consist of mild overland slopes, ditches, and culverts. The graded areas adjacent to buildings shall be sloped away with a 5% slope. Other areas shall have a minimum slope of 0,2% or as otherwise indicated.
- Ditches shall be designed to carry a 25-year storm event with velocities in accordance to minimise erosion. Erosion protection shall consist of suitable stabilising surfaces in all ditches.
- Culverts shall be designed to ensure passage of the 50-year storm peak runoff flow.

112.11. Erosion Control

Other structural and non-structural (vegetative) erosion control measures will be designed, implemented, and properly maintained in accordance with best management practices which will include the following:

- Scheduling of activities to minimise the amount of disturbed area at any one time.
- Implementation of re-vegetation as early as feasible.
- Limiting construction traffic and/or avoidance thereof on access roads and areas to be graded to the extent feasible at drainage ditches.
- Compacting loose soil as soon as possible after excavation, grading, or filling.
- Using silt fences, geo-textiles, temporary rip-rap, soil stabilisation with gravel, diversionary berms or swales, small sedimentation basins, and gravelled roads to minimise transport of sediment.
- Implementing the erosion and sedimentation control plan and ensuring that construction personnel are familiar with and adhere to it.
- Managing runoff during construction.
- The Contractor shall be responsible for checking and maintaining all erosion and sedimentation controls.

112.12. Noise Management

Keep all equipment in good working order.

Operate equipment within its specification and capacity and do not overload machines.

Apply regular maintenance, particularly with regards to lubrication.

Operate equipment with appropriate noise abatement accessories, such as sound hoods.

Sensitive social receptors shall be notified of any excessive noise-generating activities that could affect them.

Ensure that the potential noise source will conform to the international best practice, so that it will not produce excessive or undesirable noise when released.

All the Contractor's equipment shall be fitted with effective exhaust silencers and shall comply with the international best practice, for construction plant noise generation.

All the Contractor's vehicles shall be fitted with effective exhaust silencers and shall comply with the National legislation when any such vehicle is operated on a public road.

If on-site noise control is not effective, protect the victims of noise (e.g. earplugs) by ensuring that all noise-related occupational health provisions are met.

112.13. Protection of heritage resources

112.13.1. Archaeological Sites

If an artefact on site is uncovered, work in the immediate vicinity shall be stopped immediately. The Contractor shall take reasonable precautions to prevent any person from removing or damaging any such article and shall immediately upon discovery thereof inform the engineer of such a discovery. The Authorities is to be contacted and will appoint an archaeological consultant. Work may only resume once clearance is given in writing by the archaeologist.

112.13.2. Graves and Middens

If a grave or midden is uncovered on site, or discovered before the commencement of work, all work in the immediate vicinity of the graves/middens shall be stopped and the Construction Manager informed of the discovery. The relevant Authorities should be contacted and in the case of graves, arrangements made for an undertaker to carry out exhumation and reburial. The undertaker will, together with the Authorities, be responsible for attempts to contact family of the deceased and for the site where the exhumed remains can be re-interred.

112.14. Fire prevention

Fires shall only be allowed in facilities or equipment specially constructed for this purpose. A firebreak shall be cleared and maintained around the perimeter of the camp and office sites. All conditions incorporated in the requirements of the National legislation shall be implemented.

112.15. Protection of Fauna and the collection of firewood

On no account shall any hunting or fishing activity of any kind be allowed. This includes the setting of traps, or the killing of any animal caught in construction works.

On no account shall any animal, reptile or bird of any sort be killed. This specifically includes snakes or other creatures considered potentially dangerous discovered on site such an animal is discovered on site an appropriately skilled person should be summoned to remove the creature from the site. Consideration should be given to selection and nomination of such a person prior to site establishment. If no-one is available, training should be provided to at least two site staff members.

The Contractor shall provide adequate facilities for all his staff so that they are not encouraged to supplement their comforts on site by accessing what can be taken from the natural surroundings. The Contractor shall ensure that energy sources are always available for construction and supervision personnel for heating and cooking purposes.

112.16. Stockpiling, Soil Management and Protection of Flora

Clearance of vegetation shall be restricted to that which is required to facilitate the execution of the works.

Stockpiling may only take place in designated areas indicated on the approved site layout plan. Sensitive areas shall be avoided in this regard.

The Contractor shall measure the extent of all areas cleared for construction purposes and keep this figure updated.

Any area to be used for stockpiling or material laydown shall be stripped of all topsoil.

Vegetation clearance shall occur in a planned manner, and cleared areas shall be stabilised as soon as possible. The detail of vegetation clearing shall be subject to the Construction Manager's approval and shall occur in consultation with the Owner's Environmental Officer.

Stockpiles must be positioned in areas sheltered from the wind and rain to prevent erosion and dispersion of loose materials. Stockpiled soil shall be protected by adequate erosion-control measures. Soil stockpiles shall be located away from drainage lines, watercourses and areas of temporary inundation. Stockpiles (excluding ballast stockpiles) shall not exceed 2m in height unless otherwise permitted.

Topsoil shall be stockpiled separately from other materials and kept moist. Excavated subsoil, where not contaminated, must be used for backfilling and topsoil for landscaping and rehabilitation of disturbed areas. Where topsoil has become mixed with subsoil or is not up to the original standard, fertiliser or new topsoil shall be provided by the Contractor.

No vegetation located outside the construction site shall be destroyed or damaged. As far as is reasonably practicable, existing roads must be used for access to site and right of way. Before site clearance takes place, vegetation surveys will be conducted and protected species identified.

No protected plant species shall be removed without written consent from the relevant authorities. The development of new embankments or fill areas must be undertaken in consultation with the Owner's Environmental Officer.

No dumping of solid waste or refuse shall not be allowed within or adjacent to areas of natural vegetation.

The Contractor shall identify and eradicate all declared alien and invasive plant species occurring on site.

112.17. Handling and Batching of Concrete and Cement

Concrete batching shall only be conducted in demarcated areas which have been approved by Construction Manager.

Such areas shall be fitted with a containment facility for the collection of cement-laden water. This facility shall be bunded and have an impermeable surface protection to prevent soil and groundwater contamination. Drainage of the collection facility will be separated from any infrastructure that contains clean surface runoff.

The batching facility will not be placed in areas prone to floods or the generation of stagnant water. Access to the facility will be controlled to minimise potential environmental impacts. Hand mixing of cement and concrete shall be done on mortarboards and/or within the bunded area with impermeable surface or concrete slab.

Bulk and bagged cement and concrete additives will be stored in an appropriate facility at least 10m away from any watercourses, gullies and drains.

Wastewater collected in the containment facility shall be left to evaporate. The Contractor shall monitor water levels to prevent overflows from the facility. Water can be pumped into sealed drums for temporary storage and must be disposed of as liquid hazardous waste.

All concrete washing equipment, such as shovels, mixer drums, concrete chutes, etc. shall be done within the washout facility. Water used for washing shall be restricted as far as practically possible.

Ready-mix concrete trucks are not allowed to wash out anywhere other than in an area designated and approved by the Construction Manager for this purpose.

The Contractor shall periodically clean out hardened concrete from the wash-out facility or concrete mixer, which can either be reused or disposed of as per accepted waste management procedures.

Empty cement and bags, if temporarily stored on site, must be collected and stored in weatherproof containers. Used cement bags may not be used for any other purpose and must be disposed of on a regular basis in accordance with the Contractor's solid waste management system.

Sand and Aggregates containing cement will be kept damp to prevent the generation of dust.

Concrete and cement or any solid waste materials containing concrete and cement will be disposed of at a registered disposal facility. Where disposal facilities for general waste are utilised, written consent from the relevant municipality must be obtained.

112.18. Traffic Management

Vehicles are not permitted to leave access roads.

Turning of vehicles should only take place within a clearly demarcated "turn area" located within the approved construction footprint.

The contractor must co-ordinate the loading and offloading of material during the construction phase to ensure that vehicular movement is in one direction only at any one time and that side-tracks are not created on the site.

Vehicles should only be parked within designated parking areas as demarcated on the site layout plan.

112.19. Transportation of Materials

The Contractor is responsible for ensuring that all suppliers and delivery drivers are aware of procedures and restrictions (e.g. no-go areas) in terms of the CEMP and this Specification. Material must be appropriately secured to ensure safe passage between destinations during transportation. Loads must have appropriate cover to prevent spillage from the vehicles. The Contractor will be held responsible for any clean-up resulting from the failure to properly secure transported materials.

112.20. Borrow Pits and Quarries

The contractor shall make use of commercial suppliers for all rock and sand raw materials.

The Contractor shall ensure that any supplier is in possession of the required permit/license and keep record of the quantity of material supplied.

The Contractor will not make direct use of any borrow pits and quarries unless he has obtained written approval from the Construction Manager and Method Statement has been submitted and approved.

The abovementioned Method Statement will provide the detailed description of the location of the borrow pits and/or quarries and the procedures that will be followed to adhere to any pertinent national or local legislation (e.g. mineral extraction, rehabilitation, safety and noise levels).

112.21. Social and Labour Issues

The criteria for and selection of labourers, sub-contractors and suppliers for the Project shall demonstrate preference for the local community and shall be aligned with the criteria set by the Owner's in appointing the Contractor. The Contractor shall keep records of the identity of all staff.

Under no circumstances shall the Contractors engage in formal discussions with landowners without prior consent by the Construction Manager.

No activity on private property shall be allowed without written consent by the relevant landowner and the Construction Manager/the Owner's Environmental Officer.

Any damage to private property caused by the Contractor during the construction period, shall be repaired to the satisfaction of the Construction Manager.

The Contractor shall keep record of any complaint raised during the construction period relating to the Contractor's activities.

No jobseekers shall be allowed on site.

All public complaints received shall be dealt with as per Section 110.4 in the CEMP.

112.22. Rehabilitation

Contractors shall rehabilitate the entire site upon completion of work. A rehabilitation plan will be submitted to the Construction Manager for approval at least six weeks before completion. The following are critical issues to be included in the rehabilitation plan:

- Details of soil preparation procedures including proposed fertilisers or other chemicals being considered for use.
- A list of the plant species that will be used in the rehabilitation process. Note that these should all be indigenous species, and preferably species that are endemic to the area. The assistance of an appropriately qualified botanist should be sought in developing this list.
- Procedures for watering the planted areas (frequency of watering, methodology proposed etc.).
- An indication of the monitoring procedures that will be put in place to ensure the successful establishment of the plants (duration and frequency of monitoring, proposed criteria for declaring rehabilitation as being successful).
- Procedures for the prevention of the establishment and spread of alien invasive species.

113. Environmental Awareness Training

An Environmental Awareness Program is considered a necessary part of the Construction Environmental Management Plan for the Project. Training of the appropriate construction personnel will help ensure that all environmental regulations and requirements are followed which must be defined in the relevant Method Statement to be prepared by the Contractor.

Objectives of environmental awareness training are:

- Environmental Management – protecting the environment from the effects of construction by making personnel aware of sensitive environmental resources.
- Regulatory compliance – complying with requirements contained in project – specific permit conditions, also complying with requirements in regional and local regulations.
- Problem recognition and communication – training personnel to recognise potential environmental problems, i.e. spills and communicate the problem to the proper person for solution.
- Liability control - non-compliance with regulatory requirements can lead to personal and corporate liability.
- All individuals on the Project construction site will need to have a minimum awareness of environmental requirements and responsibilities. However, not all need to have the same

degree of awareness. The required degree of knowledge is greatest for personnel in the Safety, Health, and Environmental Sections and the least for the manual personnel.

- The Contractor shall present environmental awareness programmes on a weekly/bi-monthly basis (depending on project requirements) and keep record of all the environmental related training of the personnel.

114. Environmental Inspections and Audits

114.1. Environmental Inspections and Audits

Environmental inspections and audits are conducted using five basic techniques:

Interviews with Contractor’s staff including Sub-contractors and suppliers.

- Document review.
- Observations.
- Monitoring.
- Measurement and verification.

This document sets out the areas and aspects of the construction site that will be inspected or audited, the frequency of such audits, the auditor and auditee.

It should be noted that these lists are not exhaustive and that each site will have specific issues that will need to be audited.

For each construction project, the auditor and auditee are as follows:

Place	Inspector/Auditor	Auditee	Inspection/audit frequency
Workplaces	Contractor’s Environmental Officer	Contractor’s team	Daily/Weekly Inspection
Construction site	the Owner’s Environmental Officer	Contractor’s Environmental Officer	Monthly Audit
Construction site (entire area)	Environmental Control Officer	Entire Project	As required

114.2. Workplace Inspection

The Contractor’s Environmental Officer will be required to conduct weekly inspections of all workplaces for which the Contractor is responsible, including but not limited to the following:

- Contractor’s camp, recreational and canteen facilities.
- Material lay down areas.
- Liquid and solid waste storage facilities (general, hazardous, recycling and scrap).
- Workshops.
- Oil traps.
- Wash bays.
- Construction work area.

- Spray Booths.
- Haul roads.
- No-go areas.
- Storm water drains.
- Any other construction area for which the SHE Officer is responsible.

At each of these sites, the Contractor's Environmental Officer will be required daily to check for the following, where relevant:

- By observation:
 - Litter.
 - Separation of solid waste as per system.
 - Hydrocarbon spills.
 - Effectiveness of dust control measures.
 - Illegal washing out of containers in drains.
 - Wash bay drainage systems are working.
 - Correct usage of drip trays.
 - Effectiveness of oil separators.
 - Water use and wastage.
 - Pollution of watercourses and water resources.
 - Provision and use of toilet facilities.
 - Any other illegal activities.
- By document check:
 - Removal of oil for recycling as per schedule.
 - Removal of packaging as per agreements with suppliers.
 - Removal of hazardous waste by specialist Contractors as per schedule.
 - Correct placement of environmental signage and posters.
 - Document board listing emergency numbers, hazmat info sheets, etc.

The following records must also be kept up to date (information must include that of sub-contractors where relevant):

- Fuel consumption for entire contract measured in litres (including plant, generators, other equipment, vehicles etc.).
- Electricity consumption for entire contract measured in Watt hours.
- Quantities of general waste submitted for recycling measured in kilograms.
- Quantities of general waste disposed of to landfill measured in kilograms.
- Quantities of hazardous waste submitted for recycling measured in kilograms.
- Quantities of hazardous waste disposed of to landfill measured in kilograms.
- Water consumption, including water used for construction and human consumption measured in litres.

114.3. Construction Site Audit

the Owner's Environmental Officer will be required to conduct monthly inspections of the entire construction site, which may involve more than one Contractor and may include, but not be limited to the following:

- Entire site.
- Fencing.
- Environmentally sensitive areas.
- Contractor's camp, recreational and canteen facilities.
- Material lay down areas.
- Scrap yard.
- Workshops.
- Oil traps.
- Wash bays.
- Sewage plant.
- Quarries and borrow pits used for fill and construction material.
- Spoil dumping areas.
- Solid waste disposal areas.
- Liquid waste disposal areas.
- Bioremediation site.
- Area for the temporary storage of hazardous waste.
- Fuel depot and hydrocarbon storage areas.
- Construction work area.
- Concrete batching plant.
- Spray booths.
- Haul roads.
- No-go areas.
- Storm water drains.
- And any other construction areas not listed.
- At each of these sites, the Owner's Environmental Officer will be required to check for the following, where relevant:
 - By observation:
 - Litter.
 - Separation of solid waste as per system.
 - Hydrocarbon spills.
 - Use of bunding, hard standing and other protection measures.
 - Illegal dumping.
 - Effectiveness of dust control measures.

- Illegal washing out of containers in drains.
- Wash bay drainage systems are working.
- Correct usage of drip trays.
- Effectiveness of oil separators.
- Illegal use of tracks and off-road driving in no-go areas.
- Correct procedures are followed for topsoil removal and stockpiling.
- Effectiveness of erosion protection measures.
- Excess noise and vibration.
- Water use and wastage.
- Pollution of watercourses and water resources.
- Provision and use of toilet facilities.
- Any other illegal activities.
- By document check:
 - All receipts for the collection of old oil, general recycled waste and hazardous waste.
 - Correct placement of environmental signage and posters.
 - Document board listing emergency numbers, hazmat info sheets, etc.
 - Complete and accurate record of Contractor's Environmental File.

By measurement:

- Amount of water used by each Contractor (where practical and/or required by the Owner's Environmental Officer).
- Amount of topsoil removed and stockpiled.
- Amount of land stabilisation completed.
- Area re-vegetated.
- Amount of waste recycled, sent to scrap yard or disposed in dump.
- Amount of material treated in the bioremediation site.
- By monitoring:
 - Effectiveness of dust control systems.
 - Effectiveness of pollution control systems.
 - Effectiveness of rehabilitation and re-vegetation programmes.
 - Effectiveness of erosion control methods.
 - Effectiveness of noise control barriers.
- A site-specific inspection checklist will be provided to the Owner's Environmental Officer prior to site establishment.

114.4. Environmental Performance Criteria

The Contractor will be required to achieve the minimum requirement for environmental audits. The standard/minimum requirement for all environmental audits is 80% and where a conformance

score of less than 80% has been achieved, non-conformance reports (NCRs) will be issued to the Contractor.

115. Records

All environmental records/documents generated during the construction phase of the Project will be managed in terms of the Owner's Document Management Procedure for records retention.

3.4.3 Concrete Lining Repair Specifications

1. General

1.1 Work Includes

This specification describes the inspection and repair processes for precast concrete segment (PCS) linings and cast in-situ concrete linings. Repair types included in this specification address patching and plugging PCS grout holes, repair of cracks, replacement of joint filler material in cast in-situ concrete joints and contact grouting voids behind the PCS.

1.2 Related Requirements

This specification shall be supported by and read in conjunction with all relevant Chapters of the Project Specifications and the applicable Standards for testing and materials as issued by the South African Bureau of Standards (SABS) in Pretoria, South Africa.

All concrete repair products and the constituent materials thereof, and all methods and testing procedures shall conform to the applicable standards of the South African Bureau of Standard (SABS), unless otherwise specified.

1.3 Definitions

Accredited Testing Laboratory: Laboratory that has been accredited by the South African National Accreditation System (SANAS).

Annulus Grout: Grout injected during TBM tunnelling to fill the void between the cavity excavated by the tunnel boring machine and the tunnel lining

Contact Grouting: The injection of fluid, non-shrink, rapid-setting grout in the tunnel to fill voids and ensure contact between the PCS and the rock.

Cast In-Situ Concrete lining: Concrete lining cast in its final location. Cast-in-situ linings shall consist of both Unreinforced Concrete (UC) Linings and Reinforced Concrete (RC) Linings.

Grout Hole: Drilled holes or ports through the PCS lining for the purpose of injecting annulus or contact grout through the lining during tunnelling.

Precast Concrete Segment (PCS) lining: Precast concrete segments that are bolted together to form contiguous gasketed, watertight tunnel lining rings.

Refusal: For contact grouting, when approximately no grout (less than 1 litre per minute) is injected into the grout hole over a continuous 5-minute period at the specified maximum allowable injection pressure.

1.4 Submittals

At least 60 days prior to the start of work the Contractor shall submit a method statement for concrete lining repair to include:

- Concrete repair procedures,
- Repair material certificates, technical data sheets and safety data sheets,
- Grout mix designs,
- Supervisor qualifications,

- Working schedule and crew size,
- Equipment and equipment data sheets,
- Shift report forms with information described in Section 1.5.

1.5 Quality Assurance

The concrete lining repair supervisor shall have at least 5 years' experience in the repair of precast and cast in-situ concrete in tunnelling applications.

Inspection Records for each working day and work shift shall be provided that include:

- Date and shift,
- Name of inspector,
- Location of inspection (tunnel section, start/end ring number or tunnel station),
- Location of deficiencies (ring number or tunnel station and clock position),
- Photograph of deficiency identifiable to the location and date stamped.

Daily Shift Records shall be provided that include:

- Date and shift,
- Name of concrete lining repair supervisor,
- Location of repair (ring number or tunnel station and clock position),
- Type of repair (procedure and materials applied),
- Photograph of repair identifiable to the location and date stamped.

2. Products

2.1 Materials

The Contractor shall submit to the Employer's Representative full details and samples of all materials proposed for use at least 60 days before the Works are due to commence. No material shall be placed in the Works until the Employer's Representative has accepted the materials of which it is composed. Accepted materials shall not thereafter be altered or replaced by other materials without the prior acceptance of the Employer's Representative.

2.1.1 Repair Mortars

Repair mortars shall be the products described in Section 3.3 Procedure 1 and 4.

Repair mortars shall provide a minimum compressive strength of 40 MPa at 28 days.

Repair mortars shall be suitable for application in damp and wet environments.

2.1.2 Epoxy

Epoxy injection materials shall be the products described in Section 3.3 Procedure 2A and 2B.

Epoxy injection materials shall have a minimum compressive strength of 40 MPa.

2.1.3 Joint Sealant

Elastomeric polysulphide joint sealant shall be the products described in Section 3.3 Procedure 3.

2.1.4 Grout

Grout Mixes: Develop one or more grout mixes designed to completely fill the voids behind the final tunnel lining to provide acceptable set time, strength, and durability. All grout mix proportions shall be subject to review and acceptance by the Employer's Representative.

Grout shall consist of Portland cement, fluidifier and water in the proportions specified herein or as approved by the Employer's Representative. Sand may be added to the grout mix in instances of very high grout takes as approved by the Employer's Representative, but in no case, shall the grout mix contain more than 1:3 cement-sand ratio by weight.

The grout shall remain fluid long enough to be injected through the tunnel lining, to fill all voids and to set in the presence of water.

The addition of sand shall require additional fluidifier to be added to the grout mix in the proportion of 1 percent by weight of cementitious material or as recommended by the manufacturer.

Bleeding: Less than 1 percent.

Minimum Unconfined Compressive Strength:

- Determine strength by ASTM C109.
- 24 hours compressive strength: 1 MPa.
- 28 Days compressive strength: 3 MPa.

Grout shall remain fluid long enough to be injected through the PCS lining, fill voids, and set promptly.

2.1.4.1 Cement

All cements shall comply with the requirements of the following specifications, as appropriate:

- BS 1370: Specification for low heat portland cement; and
- SANS 50197 Part 1 & Part 2: Composition, specifications and conformity criteria for common cements.

All cementitious materials shall bear the official mark of the appropriate standards authority.

Unless otherwise specified, only CEM I (Portland cement), strength class 42.5 or higher, in accordance with SANS 50197-1 may be used.

Cements other than CEM I 42.5 N shall only be used with the prior approval of the Employer's Representative after the Contractor has submitted full details explaining the reasons for using this type of cement and what measures will be taken to minimize the effects of the increased heat of hydration and the slower rate of gain of long-term strength.

2.1.4.2 Sand

Fine (sand) aggregates shall comply with the requirements of SANS 1083. Where acceptance criteria are not specified, the tests shall be performed, and the results given to the Engineer for information. All aggregates for concrete shall be washed.

The grading of the fine aggregate shall comply with SANS 1083.

Acceptance of the fine aggregate gradings shall be based on a sieve analysis (using standard sieve sizes) to SANS 3001-AG1 amdt 3.

2.1.5 Water

Water for mixing or curing grout or mortar shall be clean and free from harmful matter and shall not contain more than the following concentrations of impurities or maximum allowable concentrations of each as specified in accordance with the mortar manufacturer's recommendations, whichever is more stringent:

- a. The sum of sulphates, alkali carbonates and bicarbonates: 1 000 ppm
- b. Chlorides: 500 ppm
- c. Suspended solids: 2 000 ppm

- d. Total dissolved solids: 2 000 ppm
- e. Organic impurities: 300 ppm (if pH < 5)
- f. Sugars: 100 ppm
- g. Phosphates; expressed as P₂O₅: 100 ppm
- h. Nitrates; expressed as NO₃⁻: 500 ppm
- i. Lead; expressed as Pb²⁺: 100 ppm
- j. Zinc; expressed as Zn²⁺: 100 ppm

In addition, the pH of the water shall fall within the range 4.5 to 8.5.

At the commencement of the Works the Contractor shall send a sample of the water proposed for concrete and mortar to an accredited laboratory capable of carrying out the full analysis of potable water in accordance with SANS 51008. The results of the analysis shall be submitted to the Engineer. The sample of water sent for analysis shall be taken in the presence of the Engineer.

Water shall be retested at intervals of one month.

If the source of water is changed it shall be tested as above.

Water from the tunnel invert or groundwater shall not be used to mix repair materials.

2.2 Equipment

All equipment operated underground shall be electrical or diesel powered. Diesel equipment shall be approved for underground use and shall not exceed the capacity of the ventilation system to provide fresh, breathable air.

Mixing equipment for repair materials shall meet the material suppliers requirements.

Equipment for mixing and injecting grout shall be of an approved type and of adequate size to satisfactorily mix and agitate the grout and inject it into the grout holes, in a continuous flow at the desired pressure.

Pumps: Capable of continuously developing a uniform pressure at the grout hole connection according to the following:

- Grouting operations: 500 kPa maximum.
- Pumping equipment shall deliver the grout from the holding tank to the point of injection at a steady pressure without pulsation.
- Equip with a pressure gauge as specified herein.

Two pressure gauges shall be provided, one at the grout pump and one at the manifold hookup at the collar of each hole being grouted. The accuracy of the gauges shall be periodically checked with an accurately calibrated high-pressure gauge. Gauges shall be accurate to ± 7 kPa over the allowable grouting pressure range. A spare gauge shall be available on the site at all times. All gauges shall be calibrated at least once per week.

Equipment and grouting procedures shall be such that grouting pressures at the grout hole connection in excess of the maximum specified cannot be developed. Suitable stop valves shall be provided at the point of injection at each hole so that the pressure and grout flow into the grout hole may be regulated and monitored by increasing or decreasing the flow in the grout line and for use in maintaining pressure as required until the grout has set.

The grouting equipment shall be provided with a meter to determine the volume of grout injected. The meter shall be calibrated to an accuracy of 5 percent.

Packers shall consist of pneumatic expandable rings of rubber, or other approved material attached to the end of the grout supply pipe.

Hoses and Piping

- Provide a manifold system of valves and a pressure gauge in the line at the collar of the hole to permit the accurate control and monitoring of the grouting pressure, bleeding and regulation of flow.
- Hoses for grouting operations shall have an inside diameter not less than 40 mm and shall be capable of withstanding the maximum water and grout pressures to be used.

3. Execution

3.1 Transport and Storage of Materials

The Contractor shall provide sufficient storage capacity on Site to ensure that the anticipated programme of work is not interrupted due to lack of materials, having due regard to factors such as transport, weather conditions, holidays and breakdowns.

Bagged cementitious materials shall be transported in vehicles provided with effective means of ensuring that it is protected from the weather.

Cementitious materials in bags shall be stored in a suitable weatherproof structure of which the interior shall always be dry and well ventilated. The floor shall be raised above the surrounding ground level and shall be so constructed that no moisture rises through the floor.

Cement materials shall be used in the order in which it is delivered and shall be so arranged that the oldest material is used first. Materials that exceed the manufacturers use before date shall not be used.

Cementitious materials from broken bags shall not be used.

3.1.1 Water

The Contractor shall provide water storage tanks on site with adequate capacity to ensure no interruption of the repair operations and these tanks shall be so constructed that no contamination of stored water can occur. The type and erection of water storage facilities shall be subject to the Engineers acceptance.

3.2 Inspection

Remove all sediment and sludge from concrete surfaces prior to inspection.

Provide ventilation, gas detection, portable lighting, safe aerial access, vehicular transport and personnel to perform a complete visual inspection of the concrete linings with the Employers Representative.

Measure depth of missing grout plugs. If depth exceeds tunnel lining thickness then a borescope camera shall be used to observe the extent of the void beyond the lining.

3.3 Grouting

The contact grout mix is to be designed by the Grouting Consultant retained by the Contractor who has experience with a contact and skin grout mix design.

The Grouting Consultant shall design different grout mixes for Contact Grouting activities which fill small gaps between the final lining, and bigger voids and gaps between the final lining and rock surface in the tunnel.

Employ and pay for the services of a commercial testing laboratory, acceptable to the Employer's Representative, to prepare and test the grout mix design.

Notify the Employer's Representative at least 24 hours in advance of grouting operations. All grouting shall be done in the presence of the Employer's Representative.

Place the grout quickly and continuously to avoid overworking, segregation, bleeding and disturbance of initial set. All grouting shall be done under the supervision of experienced and qualified personnel.

The development of pressures and grout take shall be closely watched and recorded.

The minimum grout injection pressure shall be the existing external hydrostatic pressure plus 1 bar. The maximum grout injection pressure shall be the existing external hydrostatic pressure plus 1.5 bars to a maximum of 5 bars.

The injection of grout during any stage of grouting shall be performed continuously, filling all spaces and voids and avoiding disturbance of grout that has taken initial set. The grouting process shall be operated and controlled so that the grout will be delivered uniformly and steadily.

Grouting will be considered complete at a particular area when refusal criteria have been achieved. Do not overstress the lining. Should it become evident that more grout is being used than could reasonably be effective, the reason for the apparent surplus shall be determined by the Contractor and remedial measures shall be taken by the Contractor at no additional cost to the Employer.

Two sets of 50 mm grout cubes (three cubes per set), shall be made from the grout line hook-up fitting for each day that grout is mixed. One set of cubes shall be tested at an age of 24 hours and the other set shall be tested at an age of 28 Days for compressive strength.

Gauges, Meters and Sensors:

- Test field gauges, meters and sensors in the presence of the Consultant a minimum of once per week using the master gauges and meters.
- Verify the accuracy of the master gauges, meters and sensors through the use of a Testing Laboratory no less frequently than once every 2 months.

3.4 Concrete Repair

Materials shall be batched by mass and placed within the time allowable by the repair material technical data sheet. Expired material shall be discarded.

Batching and mixing equipment shall be cleaned at least once per shift to prevent accumulations of expired material.

Surface finish shall be smooth and flush with the tunnel lining intrados.

All waste material shall be cleaned from the tunnel lining.

PCS lining cracks, spalls, and grout holes; PCS lining annulus voids; Cast-In-Situ RC and UC lining cracks, spalls, and joint filler materials shall be repaired and replaced in accordance with the following procedures:

Procedure 1 (to be used to fill grout holes)	
Material:	MasterEmaco S 488CI by Master Builders Solutions/Sika or approved alternative.
Procedure:	1. Break back to sound concrete and remove surplus material by low impact method. Clean and wire brush off all loose particles, dirt, and dust from holes to be filled.
	2. Measure and mix the patching compound with water in accordance with the manufacturer’s instructions. Do not retemper mixture with water.
	3. Fill the repair area and finish open edges with a steel trowel and use temporary formwork when necessary, ensuring that repair material is thoroughly compacted.
	4. Cure in accordance with manufacturer instructions.

Procedure 2A (to be used for cracks ≤6mm width) length per crack is assumed to be 1,4m (width of segment)	
Material:	Sikadur-31 Hi-Mod Gel and Sikadur-35 Hi-Mod LV by Sika Group or approved alternative.
Procedure:	1. For field repairs, stop water inflow through crack by grouting or diversion. Dry crack with heat gun to remove moisture after stopping inflow.
	2. Concrete must be clean and sound. Remove dust, laitance, grease, and foreign particles with a damp to dry cloth or sponge. Do not contaminate inside of crack.
	3. Set injection ports and seal ports and crack with Sikadur-31 Hi-Mod Gel. Apply in accordance with manufacturer instructions and allow to cure.
	4. Inject Sikadur-35 Hi-Mod LV with slow, steady pressure using appropriate injection equipment in accordance with manufacturer instructions.
	5. Wipe excess resin from the surface, adjacent to the crack, using a dry cloth.
	6. Allow to cure for 4 hours before removing any excess material with a rubbing stone.

Procedure 2B (to be used for cracks >6mm width) length per crack is assumed to be 1,4m (width of segment)	
Material:	Sikadur-31 Hi-Mod Gel and Sikadur-53 CA by Sika Group or approved alternative.
Procedure:	1. For field repairs, stop water inflow through crack by grouting or diversion.
	2. Concrete must be clean and sound. Remove dust, laitance, grease, form oil and foreign particles with a damp to dry cloth or sponge. Do not contaminate inside of crack. Dry crack with heat gun to remove moisture.
	3. Set injection ports and seal ports and crack with Sikadur-31 Hi-Mod Gel. Apply in accordance with manufacturer instructions and allow to cure.
	4. Inject Sikadur-53 CA with slow, steady pressure using appropriate injection equipment in accordance with manufacturer instructions.
	5. Wipe excess resin from the surface, adjacent to the crack, using a dry cloth.
	6. Allow to cure for 4 hours before removing any excess material with a rubbing stone.

Procedure 3 (to be used at cast in-situ construction joints)	
Material:	Epidermix 326 Primer, Duracord 15mm Backing cord and ABE Durakol or approved alternative.
	1. Do not apply without adequate ventilation.
Procedure:	2. Remove all traces of dust, laitance, form oil, any previous sealant and all other foreign material by mechanical grinding, followed by blowing out with dry oil-free compressed air. All surfaces must be completely dry in accordance with the manufacturer's instructions.
	3. Place backing cord to adjust sealant depth in accordance with the manufacturer's instructions.
	4. Apply primer. Ensure primer is brushed well into the sides of the joint face, to ensure complete coverage. Avoid over-priming resulting in excessive primer in the base of the joint. The primer film should be allowed to lose its solvent (approximately 30 minutes drying) before sealant is applied.
	5. Mix activator and paste in accordance with the manufacturer's instructions.
	6. Apply in accordance with the manufacturer's instructions. Smooth the surface in accordance with the manufacturer's instructions.
	7. Protect finished sealant from traffic until the sealant has fully cured.

Procedure 4 (to be used for spalls >25mm deep and >400cm²)	
Material:	MasterEmaco S 488CI by Master Builders Solutions/Sika or approved alternative.
Procedure:	1. Saw-cut all edges of repair to a minimum depth of 6mm.
	2. Break back to sound concrete and remove surplus material by low impact method (do not use jack hammer). Clean and wire brush off all loose particles, dirt and dust from areas to be filled.
	3. Soak burlap or sponge over the repair area to dampen with potable water; the repair area must be Saturated Surface-Dry (SSD) with no standing water.

	4. Mix MasterEmaco S 488CI in accordance with the manufacturer’s instructions.
	5. Fill the repair area and finish open edges with a steel trowel and use temporary formwork when necessary, ensuring that repair material is thoroughly compacted. Do not apply lifts of more than 50mm thickness. For repair of spalls with more than 50mm depth, wait 2 to 4 hours between each 50mm repair lift.
	6. Apply any MasterKure CC 1315WB curing compound or wet cure with burlap for a minimum of 7 days.
	7. Limitations: <ul style="list-style-type: none"> • Surface temperature range: 7°C to 32°C. • Material thickness range: 6mm to 51 mm per lift. • Feather edging is not allowed.

Procedure 5 Contact Grouting	
Material:	Contact Grout Mix Design by Contractor
Procedure:	1. Confirm missing grouting plug extends through PCS and void exists behind PCS.
	2. Install packer in grout hole such that grout will fill to the PCS extrados but not with the PCS thickness.
	3. Mix and inject grout until refusal is achieved.
	4. Wait 24 hours for grout to set.
	5. Remove packer and patch grout hole following Procedure 1.

END OF SECTION

3.4.5 DWS 2510 supply of valves**DWS2510: SUPPLY OF VALVES**

1. SCOPE

This section covers the basic specifications for the design, manufacture and supply of valves for the transportation and control of water. Valves shall be manufactured in accordance with the appropriate valve codes and standards.

2. STANDARDS AND DEFINITIONS

References

When reference is made to a code, specification or standard, the reference shall be taken to mean the latest edition of the code, specification or standard; including addenda, supplements and revisions thereto.

Supporting Specification

Where this specification is required for a project, the following specifications shall, inter alia, form part of the contract.

- a) SABS Standards
- b) BS Standards
- c) ISO Standards
- d) DIN Standards
- e) API Standards
- f) ANSI Standards.

Definitions

For the purpose of this specification the following definitions apply.

Face to face dimensions.

The distance between the two planes perpendicular to the body axis located at the extremities of the body and ports.

Nominal pressure (PN).

All pressure units throughout the valve specification will be recorded in kilopascals (kPa).

Nominal pressure (PN) is a numerical designation, which is a convenient round number for reference purposes.

Note 1 :The maximum allowable working pressure depends upon the materials, design and working temperature and shall be selected from the pressure/temperature rating tables in the appropriate standards.

Note 2 :It is designated by PN followed by the allowable working pressure.

Note 3 : This definition is in accordance with ISO 7268.

Nominal size (DN).

A numerical designation of size that is common to all components in a piping system other than components designated by outside diameters. It is a convenient round number for reference purposes and is only loosely related to manufacturing dimensions in millimetres.

Note 1 :Nominal size is designated by DN followed by the size in millimeter.

Note 2 : This definition is in accordance with ISO 6708.

All equipment of the same size (DN) designated by the same PN number shall have compatible mating dimensions.

Tight shut off valve.

A valve that has no leakage past the sealing faces in its closed position under test conditions.

Low leakage rated valve.

A valve that has an agreed leakage rate past the sealing faces when the valve is in the closed position.

Regulating valve.

A valve intended for regulating purposes, and which may have a clearance between the sealing faces when the valve is in the closed position.

Precedence

Any conflict between the technical requirements stated in the Project Specification and the technical requirements of this specification shall be referred to the Department for clarification.

Deviations

The Department will not permit any substitution or deviation from the requirements of this specification without prior approval. Any substitution or deviation from the original specification must be submitted to the Department for approval only during the tender stage of the project.

3. GENERAL CONDITIONS AND REQUIREMENTS

Nominal Pressure

Each valve is assigned a nominal pressure (PN) in kPa and shall be tested in accordance with these specified pressures.

Minimum Pressure Rating

1 000 kPa is considered to be the lowest acceptable pressure rating for any valve irrespective of lower system pressures.

Design Life

All valves and appurtenant fittings shall be designed for a useful life of forty-five (45) years under the operating conditions specified in the Project Specification.

Guarantee

All valves shall be guaranteed against faulty design, materials and workmanship for a period of five (5) years from date of delivery. During this period the Contractor shall attend to and rectify at his own cost any defects that can be attributed to faulty design, materials and workmanship. Normal wear and tear shall be excluded.

Flanges

Unless specified under the Project Specification, all valves shall be double flanged and drilled off centre to SABS 1123. Flange thickness shall be in accordance with BS 4504 for cast iron valves and SABS 1123 for fabricated valves.

Should a required flange size fall beyond the range of SABS 1123, mating dimensions shall be in accordance with ISO Standard 7005 with thickness adequate to withstand closed end pressures.

Flanges with a pressure rating between 1000 - 1600 kPa shall have flat joint faces machined in accordance with the above SABS or BS specifications. Flange pressure ratings that exceed 1600 kPa shall incorporate an "O" ring sealing arrangement. Details of the proposed "O" ring groove shall be furnished at the tendering stage for consideration.

Flange sizes exceeding and including DN 1500 or shall however incorporate an "O" ring sealing arrangement irrespective of pressure rating.

For details on the corrosion protection of the "O" ring arrangement see Standard Specification DWS 9900 Corrosion Protection.

The periphery of all flanges shall be machined to the correct outside diameter dictated by the flange pressure rating. Flanges for pipes and fabricated valves shall be machined on both faces.

All holes, shall be drilled perpendicular to the face and spot machined on the bolt head/nut bearing faces.

Sufficient clearance shall be allowed between the body and flange to enable flange bolts to be removed or tightened. Tapped holes shall only be permissible where stiffening ribs or shaft bosses interfere with bolts.

One flange of the valve body shall be clearly marked, identifying the respective pressure rating. (Refer to Paragraph 0).

Jointing Material And Fasteners

Valves shall be supplied complete with bolt units, consisting of a standard length bolt, nut and two washers. The stud unit, where applicable, shall be supplied with a standard length stud, nut and washer. A washer shall be fitted under all bolt/screw heads and nuts

The shortest standard bolt or stud that protrudes beyond the nut by a minimum of two threads when the assemblies are fully tightened shall be used. The same applies to stud units.

The manufacturer shall specify a fastening sequence for bolts (if applicable) and the torque settings (in Nm) for all bolts. These torque settings and fastening sequences shall be included in the

Operation and Maintenance Manual.

In addition each valve shall be supplied with full-face gaskets or "O" rings for joining up to adjacent flanges.

Depending on the valve location in a piping system and the atmospheric conditions, the following specifications will apply:

- a) Black bolted units to SABS 135
- b) Precision bolted units to SABS 136
- c) Galvanised bolted units to SABS 763
- d) Stainless steel bolted units to DIN 931
- e) Stainless steel set screws to DIN 933

For all valve components, i.e. bonnet covers, glands etc., drilled holes for bolts shall be perpendicular to the flange face.

All bolts and stud units shall be the same length and appropriate size and corrosion protected as per Standard Specification DWS 9900: Corrosion Protection Specification.

When required by the Project Specification, isolating bolt units shall be supplied with bolt, nut, two washers, an isolating sleeve and two isolating washers.

Contact Between Dissimilar Metals

Refer to Standard Specification DWS 9900: Corrosion Protection.

Corrosion Protection

Corrosion protection shall be as specified in Standard Specification DWS 9900: Corrosion Protection

Valve Supports And Lifting

Valves of DN 400 and larger shall have supporting feet cast integrally with the valve body.

Each valve over DN 300 or 100 kg mass, shall have two eyebolts of the required strength securely attached to the valve body to facilitate easy handling during transport and installation.

Bypassing

Where specified in a Project Specification, valves shall be fitted with bypasses and bypass valves. Piping shall be flanged.

Bypasses shall be bolted to the valve body and not to the adjoining pipe work. Piping and fittings shall be hot dipped galvanised after fabrication.

Pressure Gauges

Where specified in the Project Specification, valves shall be fitted with glycerine filled pressure gauges complete with separate stainless steel isolating ball cocks. The pressure gauges shall in general conform to SABS 1063.

The gauge face shall have a minimum diameter of 100mm with black lettering and needle on a white background. A red line or needle shall indicate the maximum safe working pressure, where applicable. Pressure gauges shall be calibrated in increments of 5 % of the full scale reading. The normal working pressure shall give a reading of between 50 and 75 % of the full scale.

Materials

Unless otherwise specified in the Particular Valve Specification, valve bodies and components shall be of the materials listed below:

Mild steel	:	BS 4360 Gr 43, SABS 1431, Gr 300WA
SG iron	:	BS 2789 Gr 420/12, SABS 936 SG 42
Cast iron	:	SABS 1034 Gr 250
Cast steel	:	BS 1504-161 Gr 480, SABS 1465 Part 1
Stainless steel components	:	BS 970 Part 4 Gr 304, 316 or 431

All material shall be new and of first grade quality. Material certificates for all materials are required.

Where copper alloys are used they shall have a zinc content of less than 0,5% and be suitably insulated against galvanic currents.

Cast material shall only be cast in moulds coated with a mould wash.

Cast components shall not be warped or distorted in any way.

No repair of cast components will be permitted unless approved by the Engineer.

The structure of cast components shall be homogeneous and free from non-metallic impurities or visible chaplets.

Items to be galvanised shall be fabricated from aluminium-killed steel or silicon-killed steel with <0,04% Silicon and 0,009 < Phosphor < 0,025%.

Construction

Bodies

Bodies shall be of sturdy construction, capable of functioning satisfactorily under abnormal operating conditions without distortion of the body or malfunction of component parts and shall be shaped to give minimum change in waterway.

Designs of bodies and components shall be free from pockets that cause eddies or accumulate debris.

Where applicable, access openings and covers shall be well designed and the creation of stress risers shall be prevented. Any gussets applicable to the design of the valve should form an integral part of the casting.

Doors and discs

Doors and discs shall where applicable be cast or fabricated as a unit with integrally cast hinge lugs.

Doors and discs shall operate freely. Their travel shall however be restricted by the provision of substantial stops, fitted with specified facings to minimise wear and damage to the corrosion protection.

Sealing faces

Sealing faces shall be deposit welded with stainless steel unless otherwise specified in the Project Specification. Where approved in writing by the Engineer the sealing faces may be securely fixed with corrosion resistant elements.

Faces shall be accurately machined and finished to meet the requirements of the specification.

Bearings

Main bearings shall, where applicable, be external and accessible without emptying or removal of the valve body from the line.

Bearings shall be designed to take any unbalanced thrusts on doors or discs.

Bearings shall retain a low co-efficient of friction. Any possibility of bearings becoming tight during service due to ageing shall be eliminated.

Where possible, bearings shall be water lubricated with a proven record of dependable operation of not less than five (5) years.

Details of the type and construction of bearings will be as specified in the Particular Valve Specification (if applicable).

Where shafts protrude through the valve at the non-drive end (NDE) they shall be sealed with bolted stainless steel, grade 316, bearing cover plates. Screwed taper plug covers are not acceptable.

Sleeve type bearings shall be fully corrosion resistant and shall be fitted in the hubs in the valve body. Steel back bearings shall not be accepted.

Bearing and shaft seals

Bearing and shaft seals shall be of the "O" ring or radial cup type with machined weep holes or grooves for drainage at the gearbox mounting flange.

Handwheels:

All valves shall be supplied complete with handwheels, which shall have the wording, "OPEN" and "CLOSE" together with directional arrows legibly cast in recesses on the upper surface of the rim.

Closure of valves shall be through the clock-wise rotation of hand wheels. All valves shall be capable of being opened or closed under an unbalanced pressure equal to the Nominal Pressure. The effort required on hand wheels to open or close valves under these conditions shall not exceed 90 N.

Handwheels shall be manufactured to ensure a close fit between the hand wheel and the mating spindle head and shall be firmly fixed to the spindle head. Loose-fitting hand wheels are not acceptable.

Lubricating points:

All lubricating points for grease gun lubrication shall be fitted with 1/8" BSP stainless steel button head type grease nipples. Nipples shall be painted red for easy identification. Electro-plated nipples will under no circumstances be accepted.

Marking

General

Each valve shall be clearly marked in accordance with the requirements of BS 5418.

Body Marking

All valve bodies shall be permanently and indelibly marked (cast in 15 mm minimum lettering size on castings or welded on fabricated valves) as follows:

- a) Nominal size (DN),
- b) Nominal pressure (PN in kPa),
- c) Arrow to indicate the direction of flow,
- d) The contract number plus identification number to identify each individual valve.

The above markings shall be legible after painting.

In order to facilitate identification at the factory and at site, all valve bonnets, gates, discs, doors, etc. shall be permanently marked (cast in or welded on in 15mm minimum lettering) with the contract number and an identification number for each individual valve.

In addition to the above, one flange for a flanged valve shall be clearly marked with a single set of machined notches (at least 3mm wide, 3mm deep and the length of the notch to suit the width of the flange). For wafer type valves, the width and depth of the notch shall be identical to that of the flanged valves. The length of the notch however shall be 8mm long.

- | | | |
|-----------------|---|-----------------------------|
| • One notch | - | 1000 kPa operating pressure |
| • Two notches | - | 1600 kPa operating pressure |
| • Three notches | - | 2500 kPa operating pressure |
| • Four notches | - | 4000 kPa operating pressure |

Identification Plate Markings

Identification plate markings shall be hard-stamped, printed or engraved on a stainless steel nameplate fitted to the valve with stainless steel screws. (Refer to drawing BF 1817 in Annexure VS1) If necessary a boss/raised face shall be cast as part of the body to fit the nameplates.

Information listed on a name plate shall be as

- a) Manufacturer's name or trade mark
- b) Nominal size (DN) in millimetres
- c) Contract number
- d) Nominal pressure (PN) in kPa
- e) Serial number

- f) Item number
- g) Material, disc/gate and body
- h) Date of manufacture
- i) Mass of valve in kg

Position Indicators

Position indicating plates shall be embossed to clearly show the fully open and closed positions as well as the $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$ intermediate positions (Refer to drawing BF 1816 in Annexure VS1).

All pulleys, brackets, pins, cables, counterweights, sleeves, indicator gears and fasteners shall be of stainless steel 304 or better.

The indicator system shall be accurately installed and calibrated to give true linear indication of the valve opening. Calibration of the indicator scale shall be done in-situ and directly recorded against the actual valve operation.

Electronic position indicators will be considered. Full details must however be supplied with the offer. Special valve position indicators, calibrated in the specified increments of the valve opening, shall be designed, supplied and installed as required in the Project Specification.

Pipes And Specials

General

Pipes and specials shall be manufactured in accordance with SABS 719 and all referred specifications. Either longitudinal butt welding or spiral welding is acceptable.

The surface finishes after fabrication shall be free of score marks, pits, weld spatter and other defects that may affect the performance of the steel in service.

Fabrication of corrosive resistant steel i.e. stainless steel and 3CR12 pipes must take place in a shop separated from carbon steel components. All equipment used in the forming and manipulation of corrosive resistant steel pipes and specials during manufacture must be clean and free of materials that may introduce defects or contaminate the metal with carbon steel.

Welding

Welding shall be in accordance with BSS 2633 and BSS 5135 for mild steel and BSS 4677 for corrosive resistant steel.

Welding of flanges shall be in accordance with BSS 806 type 6.

Weld strength shall not be less than 90 % of that of the plate calculated on the original measured thickness of the plate before welding.

The welding process used should limit heat input to a minimum. This can include the following:

- | | | |
|---------------------|---|-------|
| a) Manual metal arc | - | (MMA) |
| Metal inert gas | - | (MIG) |

Actuators

Where required actuators shall be in accordance with Standard Specification DWS 2510/02: Auxiliary Drives.

Inspection and Quality Control

Refer to Standard Specification DWS 2010: Quality Control for the general requirements for quality control.

Specific requirements for quality control and testing of valves will be covered by the following paragraphs

Pressure Test Requirements

Valves shall be pressure tested by the manufacturer to prove that all the fully assembled valves are capable of functioning satisfactorily under the specified operating conditions.

Pressure Testing

Test flanges shall be used; tapped holes in valve bodies are unacceptable. Tie-bolts or other forms of restraint applied across the blank flanges for the testing of flanged valves shall not be permitted.

Note:

- a) No valve undergoing pressure testing shall be subject to shock loading.
- b) Valves and connections shall be purged of air prior to pressure testing.

Test Fluid

The test fluid for all pressure tests shall be either water with the addition of a suitable Inhibitor, or another liquid whose viscosity at ambient temperature is equal to or less than that of water.

Test Procedures

General

Test pressures shall be maintained for not less than two (2) minute duration or as otherwise specified by the Engineer and the valves shall be watertight in all respects.

Structural and seat test shall be executed on both sides of double seated valves i.e. gate valves.

All valves, completely assembled, shall be pressure tested by the manufacturer in accordance with Table 1.

TABLE 1 : APPLICABILITY OF PRESSURE TESTS

TEST	SERVICE APPLICATION		
	TIGHT SHUT-OFF	LOW LEAKAGE	REGULATING
Structural			
(i) Body	✓	✓	✓
(ii) Disc strength	✓	✓	N/A
Seat/Seal	✓	✓	N/A

Structural test:

Body:

Uncoated valve bodies and bonnets shall be subjected to 1,5 x the maximum permissible working pressure at ambient temperature. Testing shall be carried out before valves are painted or otherwise internally coated with materials that are capable of sealing against leakage.

Both ends of the body shall be blanked off so that the valve is subjected to the full pressure stresses in all directions induced by the test pressure. The valve disc shall be in the open or partially open position during the test. There shall be no visually detectable leakage through the shell of the valve during the test period.

Assembled and fully coated valves shall be subjected to an open-end test for material strength and soundness at a pressure of 1,5 x the maximum permissible working pressure at ambient temperature.

Seepage past gland seals at the abovementioned test pressure shall not be cause for rejection, provided that the gland seals are watertight when the internal test pressure is reduced to the maximum permissible working pressure.

Disc/gate strength:

1,5 x maximum permissible working pressure at ambient temperature.

The valve shall be closed in the normal manner, and the test pressure applied to one side of the disc with the other side open to atmosphere. There shall be no visible evidence of structural damage to or deformation of the disc or of leakage through the disc during the test duration.

Seat/Seal test:

Each assembled valve shall be subjected to open-end tests for drop tightness at the permissible working pressures at ambient temperature. Valves shall be drop tight over the complete range of pressures. Valves with symmetrical seatings shall be tested in either direction.

The maximum permissible leakage shall be as given in Table 2.

TABLE 2 : TEST PRESSURE LEAKAGE RATES

VALVE TYPE	LEAKAGE RATE
Tight shut-off	Rate 3 * : No visible leakage for duration of test. Subject to the Engineer's approval Rate 1 □
Low leakage	Rate 1 : 0.1 mm ³ /s x DN

Leakage rates are defined in BS 5146 : Part 2

Test Certificate

When a test certificate is issued it shall contain a statement by the manufacturer confirming that the valves have been tested in accordance with this standard and stating the actual pressures and medium used in the test.

Anti-static

Valves designated as anti-static shall have electrical continuity between shaft, disc and body when tested in accordance with A.2 of BS 5146 : Part 1.

Pipes and specials

Uncoated pipes and specials including unflanged straight sections prior to fabrication of specials shall be subjected to 1,5x the permissible working pressure at ambient temperature.

Flange welds shall be visually inspected.

Items, which cannot be hydrostatically tested, shall be subjected to a 10 % radiographic inspection plus 100 % dye penetrant or paraffin test.

The following procedure must be observed when radiographic test methods are used:

- a) The weld length to be radiographed shall be clearly marked by the inspector using an identification symbol.
- b) This symbol shall clearly appear on the respective radiograph.
- c) The radiographed weld symbol shall not be obliterated by finishing processes until the inspector has accepted the respective weld.
- d) No alternatives to this procedure will be accepted.

Functional Test Requirement

The manufacturer shall do a functional test on each valve. This shall consist of taking the valve through one complete cycle, from fully closed to fully open and back. The manufacturer shall take particular note that the valve position indicator is correctly calibrated.

Equipment Drawings

The Contractor shall submit drawings for the following purposes:

- Tendering
- Manufacturing
- Installation
- Records

Tendering

Drawings giving detailed information of the valves, to make a proper assessment of the equipment offered, shall be submitted with the tender. The drawings shall include overall dimensions of the valves, actuator details, materials of construction, etc.

Manufacturing

After receipt of order, but before manufacturing commences, drawings in triplicate shall be submitted for approval in principle by the Engineer. These drawings shall cover the general arrangements and assemblies of the valves including flange details (drilling, PCD, number-off and diameter of holes etc.), all functional dimensions of valves and actuators, clearance between concrete face and flanges, ease of bolt and stud removal, materials, standard parts, etc.

Two weeks after submission by the Contractor, the Engineer will return one of the above mentioned prints either with his certified approval or else with his comments regarding any amendments that may be required. Drawings returned to the Contractor for amendment purposes shall be re-

submitted in its amended form within 2 weeks of the date of receipt of the drawing by the Contractor.

Approval of the above mentioned drawings by the Department shall only signify approval of the general design and layout and shall not make the Department liable for any error by the Contractor.

The Engineer has the right to suspend manufacture until a set of drawings, a draft Operation and Maintenance Manual and Quality Control Plans (for the manufacture and corrosion protection including data sheets of paint and abrasives used) are in his possession and approved in principle.

Installation

Not later than three weeks after the proposed equipment has been given approval in principle, drawings shall be submitted to allow for adequate site preparation before the arrival of the equipment. These drawings shall offer the necessary details for the programming of civil works, including foundation details.

Records

A complete set of "As Built" drawings in accordance with SABS 0111 must be completed and submitted to the Department together with an electronically saved version preferably on Compact Disc. These "As Built" drawings shall contain general arrangements, assemblies, parts lists (including part numbers) and complete component details. Drawings shall be clear, black line on white paper, unfolded and suitable for photographing for microfilming purposes. The size of the drawing shall not compromise the clarity of the print. All legends shall be in English and all dimensions in the metric system in SI units. Acceptable paper size shall be from A1 to A4.

Each drawing shall be supplied with a title block in accordance with the typical title block. (Refer to Annexure VS1 drawing BF 1819) The name of the scheme, structure and contract number shall be highlighted in bold letters.

In addition to the above, the Department will issue key information to Contractors, i.e. Internal Drawing Numbers, Codes, etc., which shall be included on all documentation and drawings.

Operating And Maintenance Manuals

Seven copies of Operating and Maintenance Manuals shall be supplied. A Draft copy of the manual shall be submitted for approval simultaneously with the drawings for manufacturing purposes. (Refer to paragraph 0.)

General contents

The purpose of these documents is to simultaneously provide a permanent and accurate record of all the equipment provided as well as a usable guide in simple language covering operating, maintenance and fault finding procedures.

Binding

The manuals shall be securely bound in A4 size, hard backed plastic/waterproof 4-ring binders, with clear pockets on the spine and front cover for the insertion of title slips, giving the Contract Number, Scheme, Dam and a description of the equipment supplied.

Drawings larger than A3 size, index and other title pages shall be contained in separate plastic pockets, bound in the appropriate section.

Layout

The sections shall be separated by plastic dividers, clearly and visibly marked to match the index, and shall be set out as follows:

- a) Title page
- b) Index
- c) Specification and Technical Schedules (supplied by the Department)
- d) General description with test certificates and final test certificate relating to any tests carried out.
- e) Operating Instructions: These shall be clear, concise and easy to follow and must include, where applicable, pre-start, safety and shut down procedures.
- f) Routine maintenance and lubricating schedule.
- g) Fault diagnosis and repair procedure.
- h) Detailed schedule of plant components giving materials, corrosion protection, part numbers, etc.
- i) Spare parts list: Suppliers/Agents details must be provided.
- j) Drawings. They shall include; general arrangements, assembly drawings, hydraulic and electrical diagrams, parts and material list in A3 and flow discharge curves. Suppliers/Agents ORIGINAL brochures and instrumental literature shall also be incorporated in the manual.

Handling And Transport

The Contractor is responsible for the safe and undamaged delivery of equipment.

After final product inspection and approval, the valve and related fittings shall be securely packed to prevent damage in transit.

In order to protect the corrosion protection (lining), the ends of valves and fittings shall be securely blanked off with sturdy blank flanges which shall be clearly marked:

“DO NOT REMOVE UNTIL FINAL INSTALLATION”

Plastic sheeting will not be acceptable.

Bolts and other small parts shall be sewn up in strong bags and crated. The bags shall be tagged using metallic tags and indicate the following information:

- manufacturer's identification and contract number,
- part numbers,
- description,
- sizes and
- quantities.

Each bag shall have the delivery address listed on a separate metallic tag.

The use of ropes, wire or chains for lifting without suitable padding is strictly forbidden. For transport or storage purposes, bunks of timber shall be used to support the components on any surface and separate them from each other.

Precaution shall be taken to support and chock the equipment to prevent movement when loading onto vehicles. Components shall be firmly lashed or chained with padded lashing supported on sawdust bags. The area of padded surfaces shall be adequate to prevent damage to coatings.

The Site Engineer shall be notified of the delivery date and of any requirements regarding off loading and storage at site.

For site delivery, the transportation and supervision during off-loading will be the responsibility of the Contractor. The final inspection and acceptance of equipment supplied will be undertaken on site after off-loading has been completed. Any damage that occurs during the handling, assembly and storage of equipment at the Manufacturer/Contractor's works, including transportation to site, shall be repaired by the Contractor at his own cost, in accordance with the valve specification and to the satisfaction of the Engineer.

Material Symbols

Where appropriate the following symbols shall be used for body material designation:

-	grey cast iron	CI
-	austenitic cast iron	AI
-	spheroidal graphite cast iron	SG
-	gunmetal	GM
-	aluminium bronze	AB
-	phosphor bronze	PB
-	carbon steel	CS
-	stainless steel	SS
-	nickel copper	NC
-	integral seat	INT
-	resilient seat	RES
-	deposited seat	DEP

3.4.6 DWS 2020 quality control

STANDARD SPECIFICATION

DWS 2020

QUALITY CONTROL

Compiled by :

Department of Water Affairs and Forestry

Directorate: Mechanical / Electrical Engineering

Subdirectorate: Technical Support Services

Obtainable from: Department of Water Affairs and Forestry

Directorate: Mechanical / Electrical Engineering

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1. GENERAL QUALITY CONTROL REQUIREMENTS

1.1 RESPONSIBILITY FOR QUALITY

The Contractor's Quality Management System shall be in accordance with ISO 9000.

The Contractor shall implement a comprehensive Quality Control programme and accept full responsibility for the quality of his workmanship and material used, irrespective of any quality surveillance that may be carried out by the Engineer or his appointed representative.

In keeping with the principles contained in the above mentioned code of practice, the Contractor or any nominated and approved Sub-Contractor(s) shall -

- (a) be responsible for compliance with all the clauses of this specification in every respect;
- (b) carry out all inspections and tests called for in the specification in the presence of the Engineer or his appointed representative. The cost of these inspections and tests shall be included in the Tender price; and
- (c) draft a quality control plan for manufacture and comply with the Departmental quality plan for corrosion protection of all components indicating all the intended stages of testing during manufacture, cleaning, preparation and application as well as hold points for independent quality surveillance.

The quality control plans will not be compromised once in agreement and shall be adhered to at all times.

1.2 NOTICE OF INSPECTION

The Engineer shall be notified at least seven days in advance, or as otherwise agreed, of impending inspections or when cleaning and first coat application are to be carried out as well as for witnessing the points in terms of the agreed Quality Control Plans.

1.3 CONTRACTOR QUALIFICATION

The Contractor and Sub-Contractor(s) shall satisfy the Project and Corrosion Engineers that they have the management, facilities and equipment, skilled staff, a quality control procedure and required test methods and standards to carry out quality control during manufacture and corrosion protection.

The above mentioned Contractors shall be subject to a Quality Audit.

1.4 SUBMISSION FOR APPROVAL

The Contractor shall submit the following to the Engineer, including data sheets where applicable, for approval:

1.4.1 For manufacture:

- (a) Drawings
- (b) A programme
- (c) A quality control plan
- (d) A draft Operation and Maintenance manual

1.4.2 For corrosion protection:

- (a) A programme
- (b) The Departmental Quality Control Plan for corrosion protection duly completed
- (c) Blast material
- (d) Coating products
- (e) Pickling and passivating products

1.4.3 Manufacture and corrosion protection programmes

The manufacture and corrosion protection programmes shall state the time and place when the following will be conducted:

- (a) Inspection of material
- (b) Hydrostatic testing of uncoated castings, pipes and fittings
- (c) Manufacture of components
- (d) Fettleing or dressing
- (e) Degreasing
- (f) Water soluble salts test
- (g) Blast cleaning and application of the first coat.
- (h) Application of intermediate and final coats.
- (i) The commencement of site repairs.

1.5 SUBSTANDARD QUALITY CONTROL

All material, certification and records of the Contractor shall be subject to examination by the Engineer.

This shall include the checking and testing of the equipment. If any deviation is found, additional testing and quality surveillance shall be carried out.

If the additional testing confirms inaccurate quality control by the Contractor, all work shall be stopped and shall only proceed after remedial action has been implemented.

1.6 ACCESS FOR SURVEILLANCE

For the purpose of carrying out quality surveillance, the Engineer or his representative shall be granted access to any part of the Contractor's premises relevant to the work being carried out, at any reasonable time.

The Contractor shall provide, at his own cost, any equipment or labour necessary to gain access to surfaces which are coated, to be coated or are in the process of being coated.

1.7 COST OF QUALITY CONTROL

The cost for quality control shall be included in the Tender price.

When surveillance results in rejection of the lot or when notice by the Contractor results in a fruitless trip, the cost borne by the Department shall be debited against the Contractor's account.

If additional inspections, tests and analyses requested by the Department prove that the corrosion protection of the equipment is in accordance with the Specification, the costs of the inspections and/or tests including transport will be defrayed by the Department. However, should the additional investigations prove that the manufacture and/or corrosion protection of the equipment does not conform to the Specification, the cost shall be defrayed by the Contractor.

The Department shall have the right, without prejudice to any other legal remedy, to deduct such costs from payments due to the Contractor under the Contract.

Where equipment or services fail to meet the Contract requirements but are nevertheless accepted at an agreed revised price, the costs with regard to inspections, test and analyses shall be for the Contractor's account unless otherwise directed by the Department.

1.8 NON-COMPLIANCE WITH THE SPECIFICATION

Equipment, materials and services that do not conform to the requirements of this Specification shall be rejected.

Such rejected equipment shall be held at the cost and risk of the Contractor who shall, when called upon, and at his own cost, repair the defects or corrosion protection according to the Contract.

Failing satisfactory repair of rejected equipment, the equipment shall be returned to the Contractor at his cost and risk without any opportunity to substitute the rejected equipment. Alternative equipment may be purchased at the Contractor's expense or an approved Contractor may be employed to do the repair to the corrosion protection.

Should the Contractor fail to comply with the provisions of the Corrosion Specification, the Completion Certificate shall not be issued.

1.9 FINAL ACCEPTANCE

No equipment shall be accepted nor be delivered to site unless all Quality Control requirements have been complied with.

2. QUALITY CONTROL RECORDS

2.1 COATING AND MATERIAL RECORDS

Quality control, material and coating records for all stages of the work, i.e. batch numbers of materials used, environmental conditions and all test data shall be recorded on the approved Quality Control Plan for manufacture and the Departmental Quality Control Plan for corrosion protection.

Certificates for all materials used shall also be required.

2.2 DATA SHEETS, SPECIFICATIONS AND CODES OF PRACTICE

The Contractor shall have available the latest issues of the following:

- (a) A copy of this Specification.
- (b) Relevant Standard Specifications and Codes of Practice.

- (c) Manufacturer's data sheets for materials to be used.

The above mentioned shall be available to all the Contractor's Quality Control and Production personnel.

2.3 QUALITY CONTROL RECORDS

Accurate and detailed quality control records shall be kept by the Contractor for all stages of the work.

Data of corrosion protection shall be recorded in the following Departmental Record sheets for corrosion protection:

- (a) Quality Control Plan
- (b) Coating Application Records
- (c) Surface Profile and Dry Film Thickness readings

All the quality control records shall be available for inspection by the Engineer or his representative.

Incomplete, inaccurate or inadequate records shall be regarded as non-compliance with the Specification.

The collection of documents for each item of equipment shall be collated and bound in a logical manner and retained by the Contractor as proof of quality achieved. These shall be available on demand for quality control and part payment releases. The records shall be handed over to the Engineer on completion of the work.

The records shall be bound in the Operation and Maintenance manuals where such manuals are supplied.

2.4 PROVISION FOR TESTING

The Contractor shall at no additional cost provide all material, samples, labour and the necessary calibrated instruments which may be required for the purpose of inspection, testing and analyses, unless otherwise specified.

3. QUALITY SURVEILLANCE BY THE ENGINEER

3.1 INSPECTION BY THE ENGINEER

Inspection of equipment shall be carried out by the Engineer, his appointed representative or a nominated and approved inspection authority at the manufacturer's and corrosion applicator's works.

The Engineer's inspection shall in no way relieve the Contractor or Sub-contractors of any of their obligations to design, manufacture and supply equipment of superior quality and workmanship in accordance with the specification.

3.2 INDEPENDENT SURVEILLANCE

The Engineer may employ an independent, technically qualified organisation to carry out quality surveillance of the work on his behalf.

The inspection authority has the right to inspect any item covered in the Contract at any stage of execution of the Contract.

Where imported supplies are to be inspected before shipment, the Contractor shall notify his suppliers abroad of the conditions applicable to inspections and also request them to notify the Department's representative abroad when consignments are ready so that arrangements for inspection may be made.

3.3 MATERIAL TESTS

The Manufacturer's material test data certification and the Contractor's quality records shall be subject to examination by the Engineer or his representative. Reasonable samples of the cleaning and coating materials to be used may be removed for testing.

Rejection of the samples shall place a hold on the use of materials of the same batch number and any components that have already been cleaned/coated with rejected material shall be reworked.

3.4 DESTRUCTIVE TESTING

The Engineer or his representative may carry out reasonable destructive tests to ascertain compliance with the Specification. Areas thus damaged shall be repaired by the Contractor to the satisfaction of the Engineer at no additional cost.

ANNEXURE QC1

QUALITY CONTROL PLAN FOR CORROSION PROTECTION

QUALITY CONTROL PLAN FOR CORROSION PROTECTION								
PROJECT:						QCP NO.		
EQUIPMENT:				SECTION:		REVISION:		
DRAWING NO.:			QTY:	FACTORY ID NO.:		COMPILED BY:		
CLIENT:						CONTACT NO.:	ORDER NO.:	
CONTRACTOR:				CONTACT PERSON:				
APPLICATOR:				CONTACT PERSON:				
APPROVALS								
CONTRACTOR NAME: SIGNATURE: DATE:		ENGINEER NAME: SIGNATURE: DATE:		DWAF QC NAME: SIGNATURE: DATE:		END USER NAME: SIGNATURE: DATE:		
LEGEND								
H - HOLD POINT		W - WITNESS POINT		S - SURVEILLANCE		R - REVIEW		
INSPECTION CODE								
1 - APPROVAL		3 - TESTING		5 - REPORT REQUIRED				
2 - MATERIAL CERTIFICATE		4 - VISUAL		6 - RECORD REVIEW				
QUALITY CONTROL								
OPERATION		INSP. CODE	INSPECTION INTERVENTIONS			ACCEPTANCE CRITERIA		
			CONTRACTOR	ENGINEER	DWAF QC	END USER		
1 Documentation approval								
1.1	Quality Control Plan	1						
1.2	Corrosion protection programme	1						
1.3	Coating material	1					Data sheets	
1.4	Pickling and passivation material	1					Data sheets	
1.5	Rough blast material	1					Data sheets	
1.6	Final blast material	1					Data sheets	
2 Pre-preparation								
2.1	Dress protrusions and pits	4					Smooth surface	
2.2	Radius sharp edges	3					_____mm minimum radius	
2.3	Repair blowholes in castings	4					To be approved by Engineer	
2.4	Fettle welds	4					Smooth contour	
2.5	Remove weld spatter, burrs, laminations, scabs and scale	4						
3 Degreasing								
3.1	Remove oil/grease contamination	3						

4 Rough blast cleaning								
4		4						
5 Measurement of soluble salts							Wet surface	Dry surface
5.1	Wax at any point	3					100 mg/m ²	500 mg/m ²
5.2	Average over 250 cm ²	3					<100 mg/m ²	100 mg/m ²
5.3	Wet cleaning/Re-blasting						Clean soft water	
6 Final blast cleaning								
6.1	Blasting material	2						
6.2	Cleanliness: Wet surface	4					Sa	
6.3	Cleanliness: Dry surface	4					Sa	
6.4	Surface profile	3					50-100 μm	
6.5	Residual dust and debris	3					0,3%	
7 Application of first coat								
7.1	Dry Film Thickness (DFT)	3					μm	
8 Application of second coat								
8.1	Dry Film Thickness (DFT)	3					μm	
9 Application of third coat								
9.1	Dry Film Thickness (DFT)	3					μm	
10 Completed system								
10.1	Visual appearance	4						
10.2	Dry Film Thickness (DFT) - Wet surface	3					μm minimum	
10.3	Dry Film Thickness (DFT) - Dry surface	3					μm minimum	
10.4	Dry Film Thickness (DFT) - flange/ mating surfaces	3					μm minimum	
10.5	Electrical Insulation Defect	3					Wet surface	
10.6	Adhesion test	3					Where required	
11 Application of third coat								
11.1	Degreasing	4						
11.2	Pickling	4						
11.3	Passivation	4						

ANNEXURE QC2

COATING APPLICATION RECORD

ANNEXURE QC3

SURFACE PROFILE AND DRY FILM

THICKNESS READINGS

SURFACE PROFILE AND DRY FILM THICKNESS READINGS

PROJECT:													
EQUIPMENT:							SECTION:						
DRAWING NO.:					QTY:		FACTORY ID NO.:						
CLIENT:							CONTRACT NO.:					ORDER NO.:	
CONTRACTOR:							CONTACT PERSON:						
APPLICATOR:							CONTACT PERSON:						

SURFACE PROFILE

DATE

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT FIRST COAT

DATE:

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT SECOND COAT

DATE

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT THIRD COAT

DATE

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DFT TFINAL COAT

DATE

WET SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

DRY SURFACE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE
TOP														
MIDDLE														
BOTTOM														

FLANGE FACES

DATE:

FLANGE SIZE	1	2	3	4	5	6	7	8	9	10	TOTAL	MIN.	MAX.	AVERAGE

COMMENTS:

.....

ANNEXURE QC4

**QUALITY CONTROL PLAN FOR
MANUFACTURE**

QUALITY CONTROL PLAN FOR MANUFACTURE OF VALVES							
PROJECT:			SECTION:			QCP NO.	
EQUIPMENT:		QTY:		FACTORY ID NO.:		REVISION:	
DRAWING NO.:						COMPILED BY:	
CLIENT:				CONTACT NO.:		DATE:	
CONTRACTOR:				CONTACT PERSON:		ORDER NO.:	
APPROVALS							
CONTRACTOR NAME:		ENGINEER NAME:		DWAF QC NAME:		END USER NAME:	
SIGNATURE:		SIGNATURE:		SIGNATURE:		SIGNATURE:	
DATE:		DATE:		DATE:		DATE:	
LEGEND							
H - HOLD POINT		W - WITNESS POINT		S - SURVEILLANCE		R - REVIEW	
INSPECTION CODE							
1 - APPROVAL		3 - TESTING		5 - REPORT REQUIRED		7 - DIMENSIONAL	
2 - MATERIAL CERTIFICATE		4 - VISUAL		6 - RECORD REVIEW		8 - DRAWINGS	
QUALITY CONTROL							
OPERATION	INSP. CODE	INSPECTION INTERVENTIONS				ACCEPTANCE CRITERIA	
		CONTRACTOR	ENGINEER	DWAF QC	END USER		
1	Documentation approval						
1.1	Drawing(s)	1					
1.2	QCP - Manufacture	1					
1.3	QCP - Corrosion Protection	1					
1.4	Draft O&M manual	1					
1.5	Draft data book	1					
2	Patters Inspection	8					
3	Casting pour - valve components						
3.1	Body						
3.2	Disc						
3.3							
3.4							
3.5							
4	Test bar identification	5					
5	Mechanical testing	3					
6	Fettling - valve components	4					
7	Release from foundry						
8	Casting/material Inspection - valve components:	4					
8.1	Check material certificates	2					
8.2	Check material reference	4					
8.3	Check casting ID Numbers	4					
8.4	Check nominal pressure PN	4				kPa	
8.5	Check nominal size DN	4				mm	
8.6	Check supporting feet	4					
8.7	Check eye bolts	4					
8.8	Check flow arrow	4					
9	Machining - valve components						
9.1	Body	8					
9.2	Disc	8					
9.3	Shafts	8					
9.4	Seat ring	8					
9.5	Retaining ring	8					
9.6	Disc seal	8					
9.7	Gearbox	8					
9.8							
10	Dimensional insp. valve body	7,8					
10.1	Check face to face dimension	7				mm	
11	Flange inspection	4					
11.1	Check flange outside diameter	7,8				mm	
11.2	Check flange thickness	7,8				mm	
11.3	Check PCD	7,8				mm	
11.4	Check number of holes drilled and tapped	7,8			off drilled and off tapped M	
11.5	Check diameter of drilled holes	7,8				mm	
11.6	Check spotfacing of drilled holes	7,8				mm dia.	
11.7	Check fit of tapped holes	7,8					
11.8	Check flange marking - notches	7,8				off notches	
11.9	Check bolt/nut clearances	7,8					
11.10		7,8					

OPERATION		INSP. CODE	INSPECTION INTERVENTIONS				ACCEPTANCE CRITERIA
			CONTRACTOR	ENGINEER	DWAF QC	END USER	
12	Hydrostatic test valve components uncoated	3					
12.1	Body						1,5 times the operating pressure
12.2							
12.3							
13	Fettling - valve components	4					Radius 2 mm min. Grind surfaces smooth
13.1	Check arrows						
14	Corrosion protection - valve components						
14.1	Body						Corrosion protection QCP
14.2	Disc						Corrosion protection QCP
14.3	Shafts						Corrosion protection QCP
14.4	Seat ring						Corrosion protection QCP
14.5	Retaining ring						Corrosion protection QCP
14.6	Gearbox						Corrosion protection QCP
14.7	Handwheel						Corrosion protection QCP
15	Fastener inspection	4					
16	Valve assembly						
16.1	Inspection of components	4					
17	Gearbox assembly						
17.1	Inspection of components	4					
18	Hydrostatic test valve						
18.1	Body	3					kPa
18.2	Disc for sealing	3					kPa
18.3	Disc for strength	3					kPa
19	Corrosion protection - final coating						Corrosion protection QCP
20	Final inspection	4					
21	Documentation review	6					
22	Timber blank flange inspection	4					
23	Final release						DWAF release certificate
24	O&M Manual						
25	Data book						

ANNEXURE QC5

TEST CERTIFICATES FOR COATING MATERIALS

TEST CERTIFICATE FOR SINGLE PACK COATING MATERIAL			
The Manufacturer's test certificate shall contain the following information to be supplied with each batch of product delivered to the Contractor:			
Tender:			
Date:			
Product:			
Reference no.:			
Batch no.:			
Colour:			
Quantity made:			
Shelf life:			
Volume solids:			
Item	Method	Parameter	Results
Fineness of grind:	SABS Method 53		
Viscosity:	SABS Method 153		
Mass/l:	SABS Method 50		
Non-volatile mass, %:	SABS Method 193		
Surface dry:	SABS Method 148		
Hard dry:	SABS Method 148		
Volume solids:	ISO 3233		

TEST CERTIFICATE FOR TWO PACK COATING MATERIAL			
The Manufacturer's test certificate shall contain the following information to be supplied with each batch of product delivered to the Contractor:			
Tender:			
Date:			
Product:			
Reference no.:			
Batch no.:			
Colour:			
Quantity made:			
Shelf life - base:			
Shelf life – curing agents			
Item	Method	Parameter	Results
Base fineness of grind:	SABS Method 53		
Base viscosity:	SABS Method 153		
Base mass/l.:	SABS Method 50		
Curing agent viscosity:	SABS Method 153		
Curing agent mass/l.:	SABS Method 50		
Mixed viscosity after 1/120 of pot life at 20oC:	SABS Method 153		
Mixed mass/l.:	SABS Method 50		
Mixed non-volatile mass, %:	SABS Method 193		
Surface dry:	SABS Method 148		
Hard dry:	SABS Method 148		
Mixed pot life (for 1 □ of mix):	SABS Method 153		
Mixed volume solids:	ISO 3233		

3.4.7 Sprayed Concrete Specification

TCTA

LHWP 2024 SHUTDOWN OUTAGE

Sprayed Concrete Specification

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1. Sprayed Concrete

1.1. GENERAL

Sprayed concrete may be applied by either a wet or dry mix process.

The term "gunite" will be used for sprayed concrete where the maximum aggregate size is less than 9,5 mm and the term "shotcrete" where the maximum aggregate size is 9,5 mm or greater. The Contractor shall have equipment available on the Site for shotcrete which can also be used for gunite if necessary.

The sprayed concrete after completion is not to be touched up, trowelled, smoothed off or worked in any way, but left undisturbed unless otherwise specified.

Where specified by the Engineer sprayed concrete shall be applied in one or more layers to reach the specified total thickness.

1.2. MATERIALS

1.2.1. Cement, Cement Extenders and Water

Cement, cement extenders, and water shall comply with the requirements of PSG Concrete (Structural).

Silica fume shall be supplied in densified form and shall comply with the following requirements:

Fineness	:	surface area not less than 18 000 m ² /kg
Particle size	:	average 0,2 micron, maximum 0,4 micron
SiO ₂ content	:	not less than 85 %
C content	:	not greater than 5 %
Total alkali content	:	not greater than 1,5 % (when combined with cement
(Na ₂ O + K ₂ O))	:	total alkali content not greater than 0,6 %)

Alternatively silica fume shall be supplied in densified form and shall comply with the requirements of SABS 1491 Part 3.

1.2.2. Aggregates

Aggregates shall comply with the requirements of Section 201 – 'Concrete' of the 'Specification for Tunnelling Third Edition' prepared by the British Tunnelling Society and the Institution of Civil Engineers except as regards grading requirements which shall be as given in Table 1/1.

The combined aggregates shall normally lie within the following grading limits by mass.

TABLE 1/1 : AGGREGATE GRADING LIMITS

Sieve Size (mm) (ASTM)	Percentage Passing	
	Structural Shotcrete	Flash Coat
13.20	100	
9.50	90 - 100	
4.75	75 - 100	100
2.36	55 - 90	80 - 100
1.18	40 - 70	50 - 85
0.60	20 - 50	25 - 60
0.30	10 - 25	10 - 30
0.15	4 - 12	2 - 10

Aggregates with gradings outside these limits will not be accepted unless the Contractor has demonstrated in full-scale trials that a satisfactory end-product can be produced with such aggregates.

1.2.3. Accelerators

Accelerators shall not be caustic or corrosive to reinforcement and shall be of a type with a history of satisfactory long term performance. References shall be obtained from suppliers and submitted to the Engineer for approval.

1.2.4. Compressed Air

Compressed air used in the process shall be clean, dry and free of oil.

1.3. DESIGN OF SPRAYED CONCRETE

Sprayed concrete shall meet the requirements specified in Table 1/2. The mix design shall be carried out by the Contractor and details submitted to the Engineer, and shall lie within the following proportions:

Cementitious content (kg/m ³)	330	-	450
Silica fume (kg/m ³)	30	-	50
Aggregate/cement ratio	3,0	-	5,0
Water/cement ratio	0,35	-	0,45

Water/cement ratio is defined as the mass of the free water in the mix divided by the total mass of cementitious material in the mix.. In the case of cement containing Fly Ash, the advice of the manufacturer of the additive (and of the cement if necessary) shall be sought before the Engineer will approve the use of the accelerating admixture. Minimum admixture should be used to obtain the specified early strength appropriate to the conditions.

In addition, the Engineer reserves the right at any time during the progress of the work to instruct the Contractor to vary the proportions of the constituents of the sprayed concrete mix or order further trial applications to ensure that adequate densities and high early strengths are maintained.

TABLE ½ - SPRAYED CONCRETE PERFORMANCE REQUIREMENTS

Sprayed Concrete Class		A
Mix Description	Test Method	Plain
Compressive Strength MPa:		
at 8 hours	ASTM C42	N/A
at 24 hours		N/A
at 28 days	(BS1881)	25
Durability Testing:		
	ASTM C642	
Boiled Absorption,		8
% Volume of Permeable Voids, %, at 7 days		17
Setting Time:		
Initial Set, mins.	ASTM C403	N/A
Final Set, mins.	(BSEN 196-3)	N/A

Notes:

- 1) The above values are all "minimum" acceptable limits, except for boiled absorption and volume of permeable voids, which are "maximum" acceptable limits.
- 2) N/A indicates "not applicable".

1.4. ACCEPTANCE TESTING

Prior to commencement of spraying concrete in the Works testing shall be carried out by the Contractor as follows:

- (a) Test panels as specified in Clause 1.13 shall be constructed in the presence of the Engineer for each mix designed and for each position required in the Works.

Cores shall be cut from the panels and 3 cores tested at each specified strength requirement.

The average of the 3 results tested at 28 days shall be not less than the 28 day specified strength. In addition, the value of each core tested shall be within 20% of the average value.

1.5. EQUIPMENT

All the equipment used for batching and mixing of materials and the application of sprayed concrete shall be of approved design and in proper working order. The sprayed concrete gun and ancillary equipment shall be of adequate capacity for the volumes to be applied. The equipment shall be capable of handling and applying 9mm maximum size of aggregate. A stand-by gun and ancillary equipment shall be available at all times. Air for the equipment is to be provided at the equipment at not less than the operating pressure specified by the manufacturer.

Dosing of additives by hand will not be permitted. Equipment for dosing additives shall be adjustable for various quantities and provide a uniform rate of discharge evenly mixed with the other ingredients of the mix. The equipment shall be capable of delivering admixture to ensure the approved dosage ratio to an accuracy of $\pm 5\%$.

Protective clothing and dust masks shall be provided for and used by all sprayed concrete operators. If at any time the Engineer considers that the environmental conditions of the area where sprayed concrete is being applied are likely to cause a health hazard or affect the quality of the finished work, he may order the Contractor to suspend operations on sprayed concrete work until steps are taken to improve the conditions in the affected area. No additional payment will be made either for the additional measures called for or for any delays resulting from such suspension of works.

1.6. BATCHING

Materials shall be batched by mass and cement shall not be added more than 1 hour before the anticipated time of placing the sprayed concrete. Aged material shall be discarded.

Feed systems for all materials are to be interconnected such that the correct proportions are maintained irrespective of feed rate and if one feed stops, the whole plant stops.

Batching and mixing equipment shall be cleaned at least once per shift to prevent accumulations of aged material.

1.7. PREPARATION OF SURFACES

Before sprayed concrete is applied, checking and correction of the existing gabion wire mesh must be approved.

All surfaces to receive sprayed concrete shall be moist and free of all traces of dirt, oil, rebound or other deleterious material.

Where sprayed concrete is to be placed over a previous layer, that layer shall be first allowed to reach its initial set and then cleaned of all rebound or other loose material to the approval of the Engineer.

Sprayed concrete shall not be applied to any surface without the prior inspection and approval of the Engineer.

1.8. PLACING

Sprayed concrete shall be placed in accordance with good practice as detailed in AC1-506R-85 Guide to Shotcrete except that with silica fume sprayed concrete it is usually possible to build up relatively thick layers in a single pass.

No sprayed concrete shall be placed in air temperatures less than 1°C. Where necessary freshly sprayed concrete shall be protected from rain or water until the surface is of sufficient hardness to prevent damage.

There shall be no inclusion of rebound in the finished work, no hollow areas, good adherence to the rock and a reasonably smooth surface finish. Rebound shall be kept clear of sprayed concrete being placed.

The minimum specified layer thickness shall be controlled by depth pins attached to the rock surface and reinforcement, or other approved means.

Before a succeeding layer is placed the existing work shall be checked for hollow or non-adhering areas and these shall be cut out and replaced to the satisfaction of the Engineer.

Finishing operations, where directed by the Engineer, such as trowelling or screeding shall be delayed until the sprayed concrete has hardened sufficiently to prevent rags or tears in the plastic sprayed concrete and will not reduce the sprayed concrete/rock bond.

Construction joints in the layer shall be formed at 45° to the face and precautions shall be taken to prevent weak and unsightly edges at construction joints. If necessary, timber strips may be temporarily fixed in place to give a neat, strong edge. Before placing the adjoining work the edge shall be cleaned and thoroughly wetted.

1.9. CURING

The use of a sprayed surface curing compound will not be permitted. The sprayed concrete shall be kept moist continuously for 3 days by spraying with a fine mist of water at intervals not exceeding 4 hours.

1.10. OPERATORS FOR SPRAYED CONCRETING

Only trained and tested operators shall be used for sprayed concreting operations. The Contractor shall satisfy the Engineer that the personnel are capable of doing work of a high standard prior to any sprayed concrete work being undertaken in the Works. For this purpose each nozzleman and back-up team shall carry out a series of trial applications in the presence of the Engineer to demonstrate their ability in applying sprayed concrete on vertical surfaces. Test panels as described in Clause 1.13 shall be made by each operator. No operator will be approved unless the 28 day crushing strengths of all tests exceed the design requirements.

The Engineer may at any time withdraw his approval of personnel if the quality of sprayed concrete applied falls below the specified standard.

1.11. DRAINAGE HOLES

25mm diameter HDPE pipe drainage holes shall be provided at 1,0 metre centres vertically and horizontally over the entire face. The drainage holes shall extend through the sprayed concrete and to prevent blocking, drainage pipes must be capped with suitable temporary caps or similar approved method.

1.12. CHECKING OF APPLIED THICKNESS

The thickness of applied sprayed concrete shall be checked by the Contractor by means of randomly positioned test holes. An acceptable procedure for these test holes shall be such that on average in any 100m² area of sprayed concrete area at least 10 test holes shall be drilled with a percussion drill where directed by the Engineer.

The Contractor may drill additional holes if he wishes at points intermediate to those located by the Engineer.

The basis of acceptance shall be that in any area of 100m², the arithmetic mean thickness of all the points checked shall be equal to or greater than the specified thickness. In addition at no point checked shall the thickness be less than 70% of the specified thickness for layers less than 100mm specified thickness or 50% for layers of 100mm specified thickness or more. Where the thickness is not acceptable, the Engineer may order an additional layer of sprayed concrete to be applied and rechecked for thickness without additional payment until the placed thickness is acceptable.

1.13. ROUTINE TESTING

On average, one test panel shall be made and tested by the Contractor for every 20m³ of sprayed concrete applied and shall be prepared by the nozzleman doing the work during normal sprayed concreting operations.

The test panels are to be made by spraying into moulds 750 x 750mm x 150mm deep with sides splayed outwards at 45° to prevent the entrapment of rebound. Panels shall be made for each mix and position sprayed by fixing the moulds to the surface being sprayed. Panels shall be clearly marked to identify the time and date of spraying and the area where they were sprayed.

In addition to these tests the Engineer may carry out hardness measurements of the applied sprayed concrete using a "Schmidt hammer" device or similar which shall be supplied by the Contractor for the purpose. In this case the equivalent compressive strength will be taken as the average of 10 individual measurements carried out on an area of not more than 2m² of the sprayed concrete surface.

Subject to satisfactory test results the testing frequency may be reduced at the discretion of the Engineer.

1.14. TESTING OF SPRAYED CONCRETE

For acceptance and routine testing, 100mm diameter cores of a length between 110mm and 150mm after the ends are cut and trimmed shall be drilled from test panels by the Contractor.

The panels shall be field cured in the same manner as the work, after which the Contractor shall deliver the panels to the laboratory where the panels shall be cured in water as specified in BS 1881.

Three cores shall be cut and tested at 3 or 7 and 28 days as directed by and in the presence of the Engineer. The compressive strengths shall be corrected to the equivalent 2:1 strength as set out in BS 1881.

1.15. FAILURE OF SPRAYED CONCRETE

For the purposes of routine testing the quality of the sprayed concrete will be considered satisfactory if every test result is at least 80% of the specified strength and if at least 80 percent of all results exceed the specified strength.

Should test samples of sprayed concrete not achieve the specified minimum strength, the Engineer will if necessary order that additional tests be carried out by the Contractor to determine new mix proportions to avoid further such failures.

If the Engineer considers that the low strengths of the applied sprayed concrete may reduce the safety of the Works and persons or be detrimental to the effectiveness of the support, he may order that the following action be taken:

- (a) apply additional thickness of sprayed concrete not exceeding the thickness originally required.

In either case no payment will be made for the defective sprayed concrete already applied, nor for the work involved in removing it from the areas where it has been applied, nor for any mesh that must be replaced, nor for any work involved in removing the resultant rubble from Site and spoiling it in an approved spoil dump. Payment will only be made for that sprayed concrete placed as specified.

PART C4: SITE INFORMATION

C4.1 LOCATION

Figure 1 below shows the location of the project which is located on the outskirts of Clarens in the Free State in South Africa and the plan of the Delivery Tunnel North (DTN) a component of the Lesotho Highlands Water Project Phase1 (LHWP1).

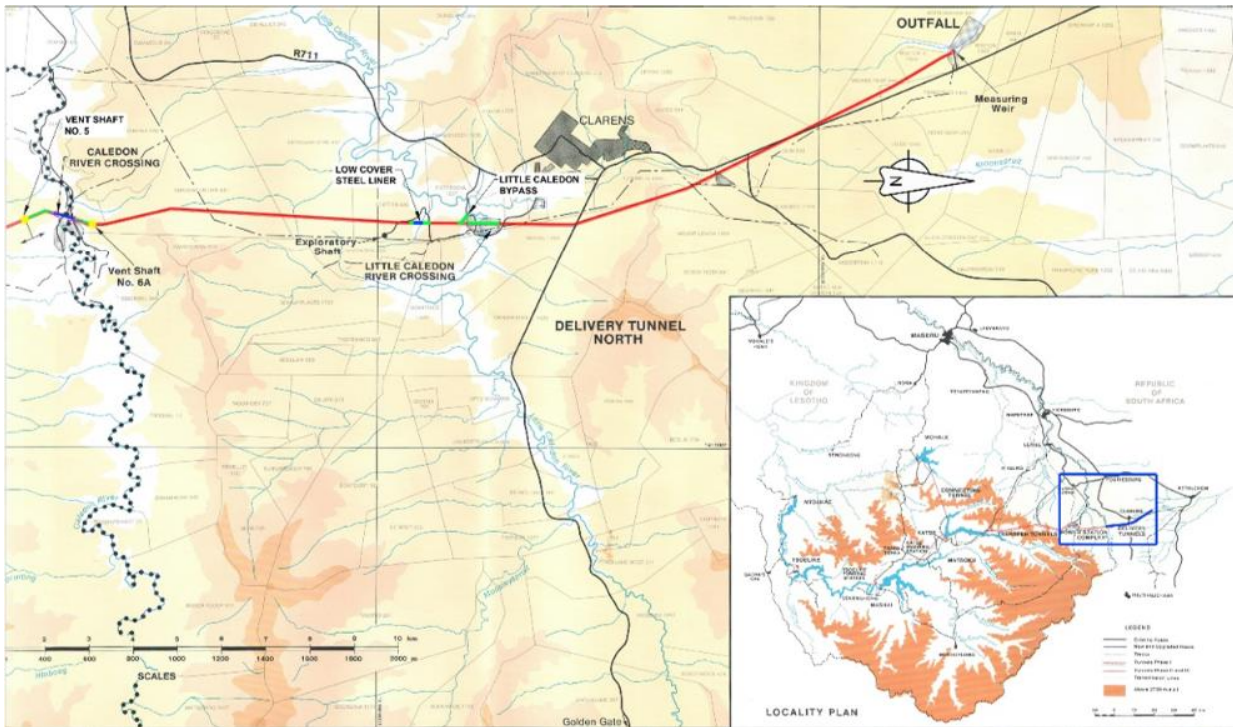


Figure 1: Locality Plan and Plan of DTN

C4.2 PROJECT SITE DESCRIPTION

The primary components of LHWP1 that will be affected by this Scope of Services is highlighted in green, in figure 2 of the simplified block diagram of LHWP1. The scope of this project is restricted to the inspection and repairs of the Delivery Tunnel North, Ash River Outfall and Ash River up to the Sol Plaatje Dam.

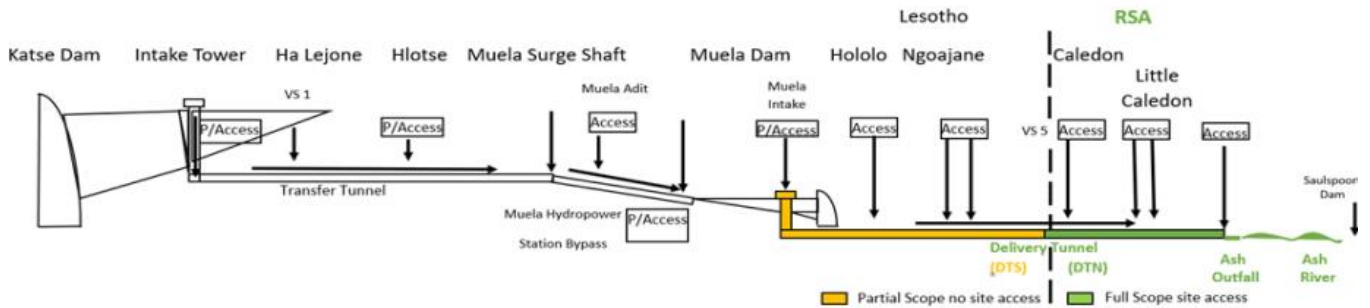


Figure2: Simplified block diagram of LHWP1, green coloured areas affected by this scope

C4.2.1 Delivery Tunnel

The Delivery Tunnel is nominally split into two sections where it transitions between Lesotho and South Africa, called DTS on Lesotho side and DTN on South African side. This project will only include the DTN portion of the Delivery Tunnel

C4.2.1.1 Delivery Tunnel North (DTN).

This part of delivery tunnel is in South African side of the border from Vent Shaft 5 (VS5) and the Ash River Outfall – 22.20 km long tunnel with two 3.4 m diameter steel lined sections amounting of 0.9 km, a 2.5 km concrete lined river crossing, and 18.8 km of precast concrete segmentally-lined of 4.60 m diameter. The tunnel has tunnel bypass off-take for water delivery to the little Caledon River as and when needed and two dewatering shafts called Caledon and Little Caledon Dewatering shafts.

C4.2.1.1.1 Access Points into the DTN

Table 1 lists access positions to the tunnel and access type for each location.

Table 2: Tunnel Access Points and Modes.

Access Point Description	Tunnel Chainage (m)	Interval (m)	Tunnel Invert Level (masl)	Adit Length (m)	Remarks
Caledon South Adit					On foot access through Caledon North Adit
Caledon North Adit	16 418	736	1 666,563	232 m to BH ⁽¹⁾	Vehicular access
Little Caledon Tunnel Bypass	25 105	8 687	1 715,610	1,5 m MH ⁽²⁾ Bypass Shaft Off-take 154m US	On foot access
Little Caledon South Adit	25 308	203	1 714,771	7 m to BH ⁽¹⁾	Vehicular access

Access Point Description	Tunnel Chainage (m)	Interval (m)	Tunnel Invert Level (masl)	Adit Length (m)	Remarks
Little Caledon North Adit	25 909	601	1 716,373	7 m to BH ⁽¹⁾	Vehicular access
Ash Outfall	37 013	11 104	1 731,250	Portal	Vehicular access

Notes:

- BH = Tunnel Bulkhead in Access Adit.
- MH = Access Manhole in pipework in Valve Chamber.

C4.2.1.1.2 Ventilation Points along the DTN

Table 2 lists ventilation positions along the tunnel and access type for each location.

Table 3: Tunnel Ventilation Points.

Ventilation Point Description	Tunnel Chainage (m)	Interval (m)	Tunnel Invert Level (masl)	Opening Size (m)	Remarks
Caledon South Adit					
Caledon North Adit	16 418	736	1 666,563	3,4 m	Vehicular access
VS No. 6A	17 042	624	1 726,055	0,23 m	73 m Deep HDPE pipe
Little Caledon Tunnel Bypass	25 105	8 063	1 715,610	3 m	31 m Deep RC shaft
Little Caledon South Adit	25 308	203	1 714,771	3,4 m	Vehicular access
Air Valve South	25 329	21	1 714,648	0,15 m	8 m S/S pipe and air valve
Little Caledon North Adit	25 909	580	1 716,373	3,4 m	Vehicular access
Air Valve North	25 916	7	1 716,556	0,15 m	8 m S/S pipe and air valve
Ash Outfall	37 013	11 097	1 731,250	4,6m	Vehicular access

C4.2.1.1.3 Types of Tunnel Linings (DTN)

Table 3 lists the lining types, tunnel diameter and length of each section of DTN.

Table 3: Tunnel Diameter and Lining Types.

Lining Type	Diameter (m)	Length (m)	Start ⁽¹⁾ Chainage (m)	Remarks
Steel	3,0	20	15 682	Caledon South Adit Bulkhead
Steel	3,0 with 3,116PCD			Caledon South Adit Bulkhead Dome semi-ellipsoidal (a/b = 2)
Concrete	4,5	104		Caledon River Crossing South

Lining Type	Diameter (m)	Length (m)	Start ⁽¹⁾ Chainage (m)	Remarks
Steel	3,4	486		Caledon River Crossing Steel Liner
Concrete	4,5	130		Caledon River Crossing North
Steel	3,0	21	16 418	Caledon North Adit Bulkhead
Steel	3,0 with 3,116PCD			Caledon North Adit Bulkhead Dome semi-ellipsoidal (a/b = 2)
Concrete	4,5	74		Caledon VS6A Drive
Concrete	5,77	569		Caledon VS6A Drive
Segment Lining	4,6	7 040		Caledon Drive
Steel	3,4	215		Low Cover Section
Segment Lining	4,6	781		Caledon Tunnel Drive
Concrete	5,77	211		Little Caledon South Drive
Concrete	2,4	52		Little Caledon Tunnel Bypass Off-take
Steel	1,6	119		Little Caledon Tunnel Bypass Off-take
Steel	3,0	7	25 308	Little Caledon South Adit Bulkhead
Steel	3,0 with 3,116PCD			Little Caledon South Adit Bulkhead Dome semi-ellipsoidal (a/b = 2)
Concrete	4,5	636		Little Caledon Siphon
Steel	3,0	7	25 909	Little Caledon North Adit Bulkhead
Steel	3,0 with 3,116PCD			Little Caledon North Adit Bulkhead Dome semi-ellipsoidal (a/b = 2)
Concrete	4,5	93		Little Caledon North Drive
Segment Lining	4,6	10 987		Ash Tunnel Drive
Concrete	4,6	10	37 013	Ash Outfall

Notes:

1. Measured from closest point of access.

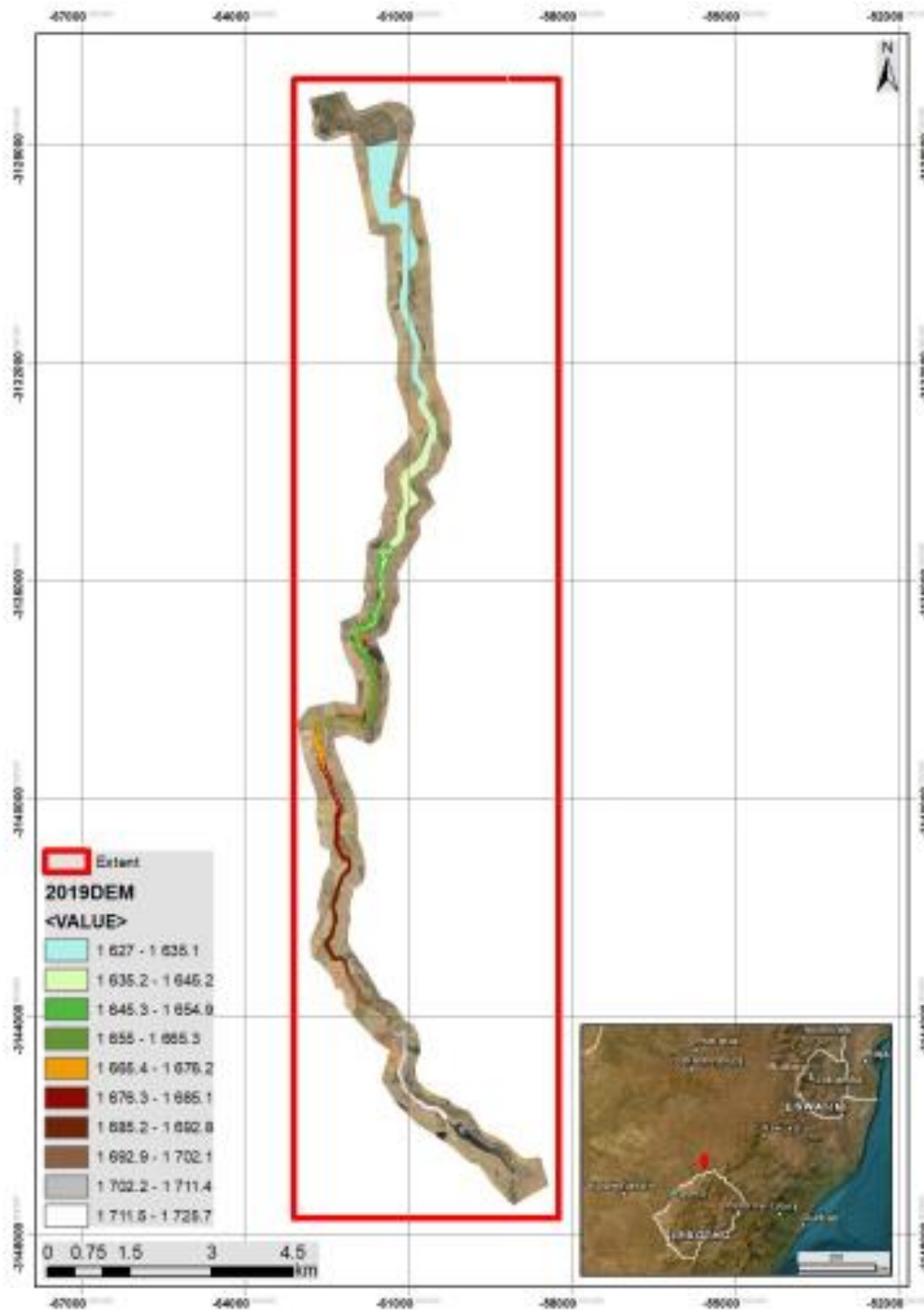
C4.2.2 Ash River Outfall

The Ash River Outfall - Works principally comprises an open 120 m long rectangular concrete channel with an upstream transition to the tunnel and equipped with a Crump Weir. The Crump Weir serves a dual purpose of a hydraulic control for the operation of the tunnel and as a flow measurement device. In the latter respect it serves as a back up to the flow measurement facility at the Ngoajane River Crossing in Lesotho. The Crump Weir level is at 1734,0 meters above sea level and is 9 m wide. Situated between DTN and the Ash River.

C4.2.3 Ash River

Ash River – 26 km between the Ash River outfall of the delivery Tunnel North and entry to Sol Plaatje Dam near Bethlehem (GPS coordinates -28,260856; 28,363541) including erosion protection structures along the river, these include Weir Site No 1, 4, 26, 34, 37,57, 68 and 72. Four Groyne structures in the vicinity of Site No 52, The work excludes the four-mini hydro-power stations, named Stortemelk, Upper Kruisvallei, Lower Kruisvallei, Merino and Sol Plaatje Dam.

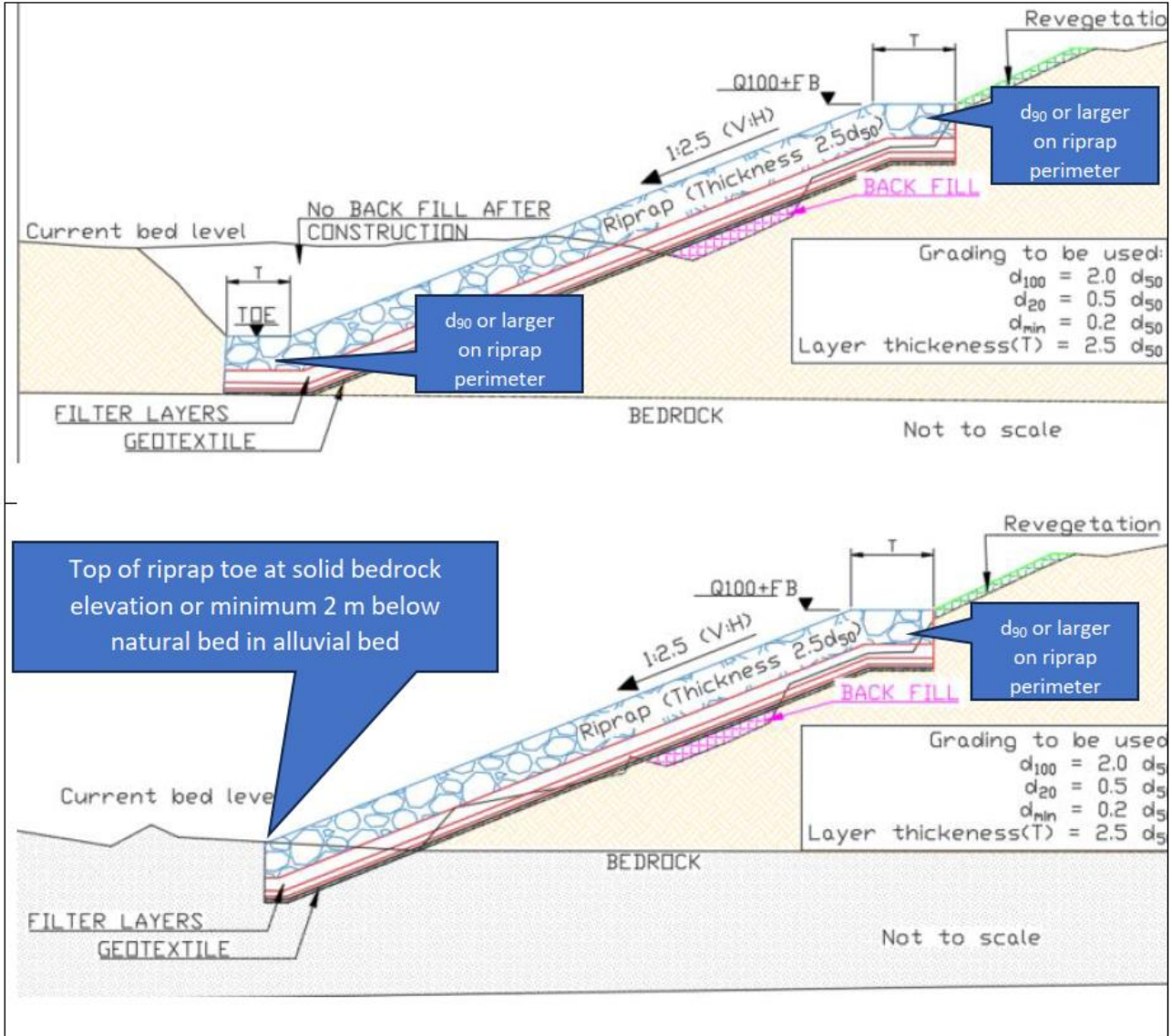
Figure 4.4.1 Location of the Ash River from the Ash River outfall near Clarens to Sol Plaatje Dam



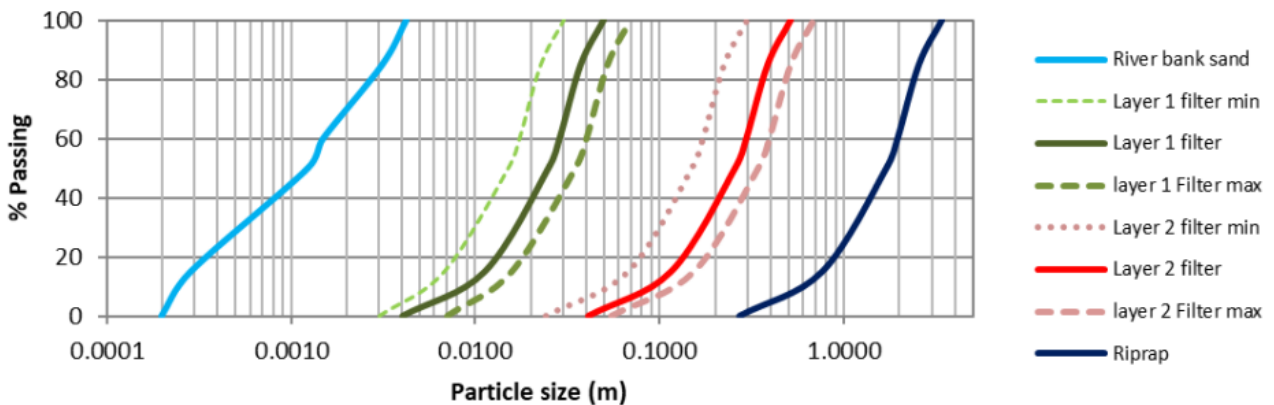
C4.2.3.1 Ash River Access

There are 18 farmlands adjacent to the Ash River across which access will be required to undertake erosion protection measures. The landowners will be informed of the envisaged project activities however further consultation will be required prior to the commencement of work.

C4.2.3.2 Typical Cross-section of riprap



C4.2.3.2 Typical grading of riprap



C4.2.4 Environmental Authorisations

TCTA is currently busy obtaining the necessary environmental authorisation to undertake the erosion repairs to the Ash River, however if authorisation is not received timeously the erosion repairs to the Ash River will be excluded from the scope of work.

D1: DRAWINGS

Delivery Tunnel North

- Drawing No. C20-0703Z Vent Shaft 5 to Little Caledon Crossing Horizontal Alignment and Longitudinal Section
- Drawing No. C20-0803Z Little Caledon Crossing to Ash Outfall Horizontal Alignment and Longitudinal Section
- Drawing No. C30-0714Z Caledon River Crossing Underground Works General Arrangement, Longitudinal Section and Setting Out Details
- Drawing No. C30-0809Z Little Caledon River Crossing Underground Works General Arrangement, Longitudinal Section and Setting Out Details
- Drawing No. C30-0865Z Ash River Outfall Underground Works General Arrangement, Longitudinal Section and Setting Out Details
- Drawing No. C31-0775Z Caledon Tunnel Little Caledon River Crossing Underground Works Tunnel Bypass General Arrangement
- Drawing No. C34-0757Z Caledon Tunnel Tunnel Works Access Adit Plugs Bulkhead and Crawl Beam General Arrangement and Details
- Drawing No. C34-0885Z Ash Tunnel Little Caledon River Crossing Surface Works Cut and Cover Siphon North Access Adit Panel Concrete Details
- Drawing No. C34-0886Z Ash Tunnel Little Caledon River Crossing Surface Works Cut and Cover Siphon South Access Adit Panel Concrete Details
- Drawing No. C36-0715Z Caledon Tunnel Caledon River Crossing Underground Works North Adit / Tunnel 1 Intersection General Arrangement and Concrete Details Sheet 1 of 2
- Drawing No. C36-0742Z Caledon Tunnel Caledon River Crossing D&B Tunnels 4,5m and 5,77m Dia. Lining North Drive Concrete and Grouting Layout Sheet 1 of 2
- Drawing No. C36-0743Z Caledon Tunnel Caledon River Crossing D&B Tunnels 5,77m Dia. Lining North Drive Concrete and Grouting Layout Sheet 2 of 2
- Drawing No. C36-0786Z Caledon Tunnel Caledon River Crossing Underground Works South Adit / Tunnel 1 Intersection General Arrangement and Concrete Details Sheet 1 of 2
- Drawing No. C36-0830Z Ash Tunnel Little Caledon River Crossing Enlarged D&B Tunnel 5,77m and 4,5m Dia. Linings Little Caledon South and North Drive Concrete Linings
- Drawing No. C38-0728Z Caledon Tunnel Caledon River Crossing Underground Works Dewatering Works General Arrangement
- Drawing No. C38-0777Z Caledon Tunnel Little Caledon River Crossing Underground Works Tunnel Bypass Longitudinal Section and Lining and Grouting Details
- Drawing No. C38-1114Z Caledon Tunnel Little Caledon River Crossing Underground Works Tunnel Bypass Outlet Structure Pipework and Valves

- Drawing No. C38-1217Z Ash Tunnel Little Caledon River Crossing Surface Works Dewatering Works Steelwork Details
- Drawing No. C38-1218Z Ash Tunnel Little Caledon River Crossing Surface Works Dewatering Works Pipework and Valves

D2: PRO-FORMA DOCUMENTS
Project Interim Report (ED105P)

cidb PROJECT ASSESSMENT SCHEME; STANDARD FOR INDIRECT TARGETING PROJECT INTERIM REPORT To be completed for each qualifying enterprise	
Section A: Employer Information	
cidb Employer Number	<input style="width: 100%;" type="text"/>
Employer Name	<input style="width: 100%;" type="text"/> <input style="width: 100%;" type="text"/>
Section B: Contractor / JV Information	
cidb Contractor Registration Number of main / lead contractor	<input style="width: 100%;" type="text"/>
Name of contractor	<input style="width: 100%;" type="text"/>
cidb Contractor Registration Number of Joint Venture Partner 2	<input style="width: 100%;" type="text"/>
Name of contractor /Joint Venture	<input style="width: 100%;" type="text"/>
cidb Contractor Registration Number of Joint Venture Partner 3	<input style="width: 100%;" type="text"/>
Name of contractor /Joint Venture	<input style="width: 100%;" type="text"/>
cidb Contractor Registration Number of Joint Venture Partner 4	<input style="width: 100%;" type="text"/>
Name of contractor /Joint Venture	<input style="width: 100%;" type="text"/>

Project Completion Report (ED101P)

cidb PROJECT ASSESSMENT SCHEME; STANDARD FOR INDIRECT TARGETING PROJECT COMPLETION REPORT To be completed for each qualifying enterprise	
Section A: Employer Information	
cidb Employer Number	<input style="width: 100%;" type="text"/>
Employer Name	<input style="width: 100%;" type="text"/> <input style="width: 100%;" type="text"/>
Section B: Contractor / JV Information	
cidb Contractor Registration Number of main / lead contractor	<input style="width: 100%;" type="text"/>
Name of contractor	<input style="width: 100%;" type="text"/>
cidb Contractor Registration Number of Joint Venture Partner 2	<input style="width: 100%;" type="text"/>
Name of contractor /Joint Venture	<input style="width: 100%;" type="text"/>
cidb Contractor Registration Number of Joint Venture Partner 3	<input style="width: 100%;" type="text"/>
Name of contractor /Joint Venture	<input style="width: 100%;" type="text"/>
cidb Contractor Registration Number of Joint Venture Partner 4	<input style="width: 100%;" type="text"/>
Name of contractor /Joint Venture	<input style="width: 100%;" type="text"/>
Contact Person Title	<input style="width: 100%;" type="text"/>
Initials	<input style="width: 100%;" type="text"/>
Surname	<input style="width: 100%;" type="text"/>

Declaration (ED104P)

