



# MUNICIPAL COUNCIL OF MBABANE

## REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER

Tender No: 31-2018/2019

Closing Date: 13 December 2019

<b>TENDERER (PRINT NAME)</b>	
<b>ADDRESS OF TENDERER</b>	
<b>TELEPHONE</b>	<b>FACSIMILE</b>
<b>E-MAIL</b>	<b>DELIVERY PERIOD</b>
<b>TENDER AMOUNT (SZL) (INCL. VAT)</b>	
<b>TENDER AMOUNT (WORDS) (INCL. VAT)</b>	
<b>SIGNATURE OF TENDERER</b>	<b>DATE</b>

Employer	Employer's Agent
The Chief Executive Officer Municipal Council of Mbabane P.O. Box 1 Mbabane H100  Tel: +268 2409 7000 Fax: +268 2404 2611	Pasco Waste and Environmental Consulting (Pty) Ltd P O Box 41474 GARSFONTEIN EAST Pretoria 0060 Mr. Pieter Smuts Tel: +27 12 998 7747 Fax: +27 12 993 2754

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....

## **VERY IMPORTANT NOTICE ON DISQUALIFICATIONS:**

A bid not complying with the unconditional requirements stated hereunder will be regarded as not being an "Acceptable bid", and as such will be rejected. "Acceptable bid" means any bid which, in all respects, complies with the conditions of bid and specifications as set out in the bid documents.

1. If any pages have been removed from the bid document, and have therefore not been submitted, or a copy of the original bid document has been submitted.
2. Failure to complete the schedule of quantities as required, i.e. only lump sums provided.
3. Scratching out, writing over or painting out rates, without initialling next to the amended rates or information, affecting the evaluation of the bid.
4. The use of correction fluid (i.e. tippex) or any erasable ink, e.g. pencil.
5. Non-attendance of mandatory/compulsory:
  - a. Site inspections or;
  - b. Information/Clarification meetings
6. The Bid has not been properly signed by a party having the authority to do so, according to the example of "Authority for Signatory"
7. No authority for signatory submitted – See example, where it is stated that a duly signed and dated original or certified copy of the company's relevant resolution (for each specific bid) of their members or their board of directors, must be submitted.
8. The bidder attempts to influence, or has in fact influenced the evaluation and/or awarding of the contract
9. The bid has been submitted either in the wrong bid box or after the relevant closing date and time
10. If any municipal rates and taxes or municipal service charges owed by the bidder or any of its directors to the municipality, or to any other municipality or municipal entity, are in arrears for more than three months.
11. If any bidder who during the last five years has failed to perform satisfactorily on a previous contract with the municipality, municipal entity or any other organ of state after written notice was given to that bidder that performance was unsatisfactory.
12. The accounting officer must ensure that irrespective of the procurement process followed, no award may be given to a person –
  - a. who is in the service of the state, or;
  - b. if that person is not a natural person, of which any director, manager, principal shareholder or stakeholder, is a person in the service of the state; or;
  - c. who is an advisor or consultant contracted with the municipality in respect of contract that would cause a conflict of interest.
13. Failure to provide:
  - a. An original and valid tax compliance certificate
  - b. Labour compliance certificate
  - c. Trading licence
  - d. ENPF certificate
  - e. Form C and form J
  - f. Police clearance for the directors
  - g. Declaration of interest / conflict of interest
  - h. Declaration if subject to suspension as per section 55 of the procurement act
  - i. written proof of registration with the CIC, in an appropriate contractor grading designation (category), as required in the bid documentation; or

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- j. written proof of application to the CIC for registration as a contractor in an appropriate designation (category), as required in the bid documentation.
14. Bid offers will be rejected if the bidder or any of his directors is listed on the Register of Bid Defaulters in terms of the Prevention and Combating of Corrupt Activities Act as a person prohibited from doing business with the public sector.
  15. Bid offers will be rejected if the bidder has abused the MCM's Supply Chain Management System.
  16. Failure to attach a copy of a valid signed Joint Venture/Consortium agreement (if applicable) to the bid document.
  17. Form of offer not completed and signed by the authorised signatory.
  18. The minimum number of 75 evaluation points for quality criteria not obtained as indicated in the tender data.

The quality criteria and maximum score in respect of each of the criteria are as follows:

Quality criteria	Maximum number of points
Experience of Tenderer on similar projects	35
Delivery of previous projects (reference letter)	20
Key personnel proposed for the project	20
Construction equipment available for the project	10
Bank rating	15
<b>Maximum possible score for quality (M<sub>s</sub>)</b>	<b>100</b>

Score quality (functionality) in each of the categories in accordance with the Tender Data and calculate total score for quality.

**Bids containing any one or more of the following errors or omissions will not be rejected, provided that when the bid is awarded to such a bidder, the error or omission is corrected:**

- Failure to initial each page of the bid document

**NOTE:**

IN THIS DOCUMENT AND OTHER DOCUMENTS REFERRED TO BUT NOT ATTACHED, THE FOLLOWING WORDS ARE SYNONYMOUS WITH EACH OTHER.

1. CLIENT, EMPLOYER, MUNICIPAL COUNCIL OF MBABANE (MCM).
2. BID, TENDER AND VARIATIONS THEREOFF

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3. JOINT VENTURE / CONSORTIUM

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**MUNICIPAL COUNCIL OF MBABANE**

DEPARTMENT NAME: **TECHNICAL SERVICES**

**Tender No: 31-2018/2019**

FOR

**REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER**

**SUMMARY FOR BID OPENING PURPOSES**

NAME OF BIDDING ENTITY: .....

.....

PHYSICAL STREET ADDRESS:	POSTAL ADDRESS:

TELEPHONE NUMBER : .....

FAX NUMBER : .....

E-mail ADDRESS : .....

CONTRACT PRICE : SZL .....  
(Amount brought forward from the Form of Offer and Acceptance)\*

Signed by authorised representative of the Bidding Entity: .....

DATE: .....

- Should any discrepancy occur between this figure and that stated in the Form of Offer and Acceptance, the latter shall take precedence and apply.

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# MUNICIPAL COUNCIL OF MBABANE

DEPARTMENT NAME: **TECHNICAL SERVICES**

## Tender No: 31-2018/2019

FOR

**REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER**

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DEPARTMENT NAME: **TECHNICAL SERVICES**

**Tender No: 31-2018/2019**

FOR

**REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER**

**T.1PART T1 BIDDING PROCEDURES**

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## T1.1 BID NOTICE AND INVITATION TO BID

ADVERTISED IN: xxxxxxxx  
PUBLISHING DATE: xx / xxxxx / 2019  
NOTICE/REF. NO.: xxxxxxxx

### **MUNICIPAL COUNCIL OF MBABANE**

Bids are hereby invited for the following:

Sanitary Landfill Facility

<u>CONTRACT NO.:</u>	<u>DESCRIPTION:</u>	<u>DOC. FEE</u>	<u>CLOSING DATE:</u>
Tender No: 31-2018/2019	REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER	SZL 1000-00	13 December 2019

The works mainly comprise:

- Clearing away damaged material from the works area
- Prepare areas to be repaired
- Supply and install new material
- Replace drainage material on top of liner

**Preference will be given to local Mbabane based companies. Bidders must limit the utilization of their permanently employed personnel to Key Personnel and all other personnel and labourers must be recruited locally.**

*Bidders must be registered, or must have applied for registration, or be capable of being so registered prior to submission, with the Construction Industry Council (CIC) in a contractor grading designation determined in accordance with the sum tendered for **Category CS 5 or equivalent or better.***

*PLEASE NOTE THAT AN ORIGINAL AND VALID ORIGINAL COMPANY'S TAX COMPLIANCE CERTIFICATE (OR IN THE CASE OF A JOINT VENTURE, OF ALL THE PARTNERS IN THE JOINT VENTURE) MUST BE SUBMITTED WITH THE BID DOCUMENT.*

**Bid documents will be available on the 8<sup>th</sup> November 2019 and thereafter on weekdays from 08:00 until 15:00 ONLY**, upon payment of a cash non-refundable document fee of SZL 1000-00 per set, at the Department of Finance reception, Municipal Council of Mbabane, Mahlokohla Street, Civic Office, Mbabane.

**A compulsory site/clarification meeting** will be held at **10:00 on 15<sup>th</sup> November 2019**. Prospective bidders are requested to meet on the said date and time at the Mbabane landfill site located in Mpolonjeni. Bid documentation will **not** be available at the compulsory site/clarification meeting and the Engineer will not be available for inspection purposes on any other date and time.

Bids are to be completed in accordance with the conditions and bid rules contained in the bid documents and supporting documents must be sealed and externally endorsed with the **CONTRACT NUMBER AND DESCRIPTION** and placed in **bid box** on the First Floor, Civil Centre, Municipal Council of Mbabane not later than **12:00 on 13<sup>th</sup> December 2019**.

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Bids will be opened immediately thereafter, in public, in the Council Chamber, 2<sup>nd</sup> Floor, at above-mentioned address.  
**All bids shall hold good for 90 days as from the closing date of bids.**

Bids which are not received and/or deposited in the specified bid box before 12:00 on the closing date for the bid mentioned hereinbefore, **will be marked as late bids and such bids shall in terms of the SCM Policy of the MUNICIPAL COUNCIL OF MBABANE, not be considered by the MCM as valid bids.**

**General Enquiries** must be directed to **Mr Muzikayise Masina or Mrs Makhosazane Mangwe** at telephone number **+268 2409 7000** and **Technical Enquiries** must be directed to **Mr. Pieter Smuts of Pasco Waste and Environmental Consulting** at telephone number **+27 12 998 7747** or fax **+27 12 993 2754** or e-mail at **pieter@pascowaste.co.za**

Bidder's attention is specifically drawn to the provisions of the bid rules which are included in the bid documents. The lowest or any bid will not necessarily be accepted and the Council reserves the right not to consider any bid **not suitably endorsed or comprehensively completed**, as well as the right to accept a bid in whole or part. **Bids completed in pencil will be regarded as invalid bids. Bids may only be submitted on the documentation provided by the MCM.**

**TELEFAX OR E-MAIL BIDS ARE NOT ACCEPTABLE**

**MR GIDEON MHLONGO  
CHIEF EXECUTIVE OFFICER  
MCM**

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## **T1.2** **BID DATA**

Bid should read tender and vice versa throughout the document. – implying both words have the same meaning. The conditions of bid are the **Standard Conditions of Tender** as contained in Annex F of the CIDB Standard for Uniformity in Construction Procurement, as printed in the **RSA** in Annexure F of the CIDB Standard for Uniformity for construction Procurement, Board Notice 136 Government Gazette No 38960 of 10 July 2015. A copy is attached hereto, immediately after page 17.

The under mentioned items of data and deviations will have precedence over the Standard Conditions of Bid Conditions in Annex F.

The **Standard Conditions of Bid** for Procurements make several references to the bid data for details that apply specifically to this bid. The bid data shall have precedence in the interpretation of any ambiguity or inconsistency between it and the standard conditions of bid.

<b>Clause number</b>	<b>Data</b>
F.1.1 ACTIONS	The Employer is: The Chief Executive Officer MUNICIPAL COUNCIL OF MBABANE Private Bag 1 Mbabane H100
F.1.2 TENDER DOCUMENTS	<p>The bid documents issued by the Employer comprise:</p> <p><b>THE BID</b></p> <p><b>Part T1 Bidding procedures</b> Part T1.1 Bid notice and invitation to bid Part T1.2 Bid data</p> <p><b>Part T2 Returnable documents</b> Part T2.1 Returnable documents required for bid evaluation purposes Part T2.2 Other documents required for bid evaluation purposes Part T2.3 Schedules that will be incorporated in the contract</p> <p><b>THE CONTRACT</b></p> <p><b>Part C1 Agreements and contract data</b> C1.1 Form of offer and acceptance C1.2 Contract data C1.3 Form of Guarantee C1.4 Agreement in terms of Occupational Health and Safety Act, 1993 (RSA)</p> <p><b>Part C2 Pricing Data</b> C2.1 Pricing Instructions C2.2 Bill of Quantity</p> <p><b>Part C3 Scope of Works</b> C3 Scope of Works / Project Specification</p> <p><b>Part C4 Site Information</b> C4 Site Information</p>

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Clause number	Data
F.1.4 COMMUNICATION AND EMPLOYER'S AGENT	The Employer's agent is: Name: Pasco Waste and Environmental Consulting CC, Mr. Pieter Smuts Address: 653 Aurelia Street, Garsfontein, Pretoria. Tel: +27 12 998 7747 Fax +27 12 993 2754 E-mail: <a href="mailto:pieter@pascowaste.co.za">pieter@pascowaste.co.za</a>
F.1.5.2	Delete CIDB website and government tender bulletin for the media and replace with Council website and ESPPRA website.
F.2.1 ELIGIBILITY	<p>Only those bidders who are registered with the CIC, or who can provide written proof of their application for registration with the CIC and are likely to be accepted, prior to the evaluation of bids, in a contractor grading designation equal to or higher than a contractor grading designation determined in accordance with the sum bidded for Category CS 5 or equivalent or better of construction work, or by a contractor who is registered as a potential emerging enterprise in terms of these regulations at a contractor grading designation, one level higher than the contractor's registered grading designation, provided that the employer:</p> <ul style="list-style-type: none"> <li>(a) is satisfied that such a contractor has the potential to develop and qualify to be registered in that higher grade; and</li> <li>(b) ensures that financial, management or other support is provided to that contractor to enable the contractor to successfully execute that contract</li> </ul> <p>are eligible to submit bids.</p> <p>Joint Ventures are eligible to submit bids provided that:</p> <ul style="list-style-type: none"> <li>(1) every member of the joint venture is registered with the CIC, or who can provide written proof of their application for registration with the CIC, prior to the evaluation of bids;</li> <li>(2) the lead partner has a contractor grading designation in the for Category CS 5 or equivalent or better of construction work; and</li> <li>(3) the combined contractor grading designation calculated in accordance with the Construction Industry Council Regulations is equal to or higher than a contractor grading designation determined in accordance with the sum bidded for Category CS 5 or equivalent or better of construction work, are eligible to submit bids.</li> </ul>
F.2.3 CHECK DOCUMENTS	Bidders must examine the bid documents upon receipt to ensure that all pages and drawings (if applicable) are included and are to report any missing pages or drawings. Drawings which are illegible or indistinct, and errors or ambiguities in the Specifications, Schedule of Quantities and Drawings or any contradictions between the Specifications, Schedule of Quantities and Drawings in order to obtain rulings on all such errors, ambiguities or discrepancies. No claim for extras based on such errors, ambiguities or discrepancies will be considered after the opening of bids. Bidders having any queries relating to discrepancies in or omissions from the bid document shall contact the Employer immediately.
F.2.7 CLARIFICATION MEETING	<p>The arrangements for the <b>compulsory clarification meeting</b> are:</p> <p><b>Location:</b> Mbabane landfill site located at Mpolonjeni, Mbabane.</p> <p><b>Date:</b> 15/ 11 / 2019      <b>Starting time:</b> 10:00</p> <p>The site inspection or clarification meeting will be at the bidders own expense insofar as transport and accommodation is concerned and the bidders must make their own arrangements in this regard.</p>

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Clause number	Data
F.2.12 ALTERNATIVE TENDER OFFERS	<p>If a bidder wishes to submit an alternative bid offer, the only criteria permitted for such alternative bid offer is that it demonstrably satisfies the Employer's standards and requirements, the details of which may be obtained from the Employer's Engineer.</p> <p>Calculations, drawings and all other pertinent technical information and characteristics as well as modified or proposed Pricing Data must be submitted with the alternative bid offer to enable the Employer to evaluate the efficacy of the alternative and its principal elements, to take a view on the degree to which the alternative and to evaluate the acceptability of the pricing proposals. Calculations must be set out in a clear and logical sequence and must clearly reflect all design assumptions. Pricing Data must reflect all assumptions in the development of the pricing proposal.</p> <p>Acceptance of an alternative bid offer will mean acceptance in principle of the offer. It will be an obligation of the contract for the bidder, in the event that the alternative is accepted, to accept full responsibility and liability that the alternative offer complies in all respects with the Employer's standards and requirements.</p> <p>The modified Bid Data must include an amount equal to 5% of the amount bid for the alternative offer to cover the Employer's costs of confirming the acceptability of the detailed design before it is constructed.</p>
F.2.13.1 SUBMITTING A TENDER OFFER	Bidders may offer to provide any of the parts, or combinations thereof, of the works, services or supply identified in the contract data.
F.2.13.2 SUBMITTING A TENDER OFFER	<p>Submittals with regards to experience:</p> <p>The project consists of 2 parts i.e. a civils earthworks contract with ancillary works and a nominated subcontract dealing with the installation of composite geosynthetic liner materials across the entire surface of the landfill cell. Once the civils works contract is complete as per the drawings and specifications the subcontractor will install the liner system. Upon completion of the liner the civils contractor will return to complete the works on top of and around the lined landfill cell. The civils contractor for this contract needs to prove their understanding of the required sequence by providing a proposed construction schedule as part of the tender.</p>
F.2.13.3 SUBMITTING A TENDER OFFER	<p>The <b><u>whole original</u></b> bid document, <b><i>as issued by the MCM</i></b>, shall be submitted. <b><i>No copies will be accepted.</i></b></p> <p>Bids may only be submitted on the Bid documentation issued by the MCM.</p>
F.2.13.5 SUBMITTING A TENDER OFFER	<p>The Employer's address for delivery of bid offers and identification details to be shown on each bid offer package are:</p> <p>Location of bid box: Bid box</p> <p>Physical address: The Projects Engineer Municipal Council of Mbabane Civic Office Mahlokohla Street Mbabane</p> <p>Identification details: Contract Number : 31-2018/2019</p> <p><b>REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER</b></p>

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Clause number	Data
F.2.15 CLOSING TIME	The closing time for submission of bid offers is: <b>12:00</b> on 13 / 12 / 2019. Telephonic, telegraphic, telex, facsimile or e-mailed bid offers will <b>not</b> be accepted.
F.2.16 TENDER OFFER VALIDITY	The bid offer validity period is <b>90 days</b>
F.2.23 CERTIFICATES	The bidder is required to <b>submit with his bid</b> . (1) either a Certificate of Contractor Registration issued by the Construction Industry Council or a copy of the application Form for registration in terms of the Construction Industry Council Act (Form F006); and (2) an Original and Valid Tax Compliance Certificate or copy thereof, issued by the Eswatini Revenue Authority (ERA); and (3) Labour compliance certificate (4) ENPF certificate (3) Audited annual financial statements for the past three (3) years or since the date of establishment if established during the past three (3) years, if you are required by law to prepare annual financial statements for auditing, for all procurement expected to exceed SZL10 million (VAT included). (4) Certificate of ISO14001, Environmental Management Systems accreditation, issued by the South African National Standards bureau or written confirmation from SANS that the company is in process to obtain certification.
F.3.4 OPENING OF BID SUBMISSIONS	The time and location for opening of the bid offers are: Immediately after the closing time for submission of bid. Location:     Municipal Council of Mbabane Council Chambers Second Floor Civic Office Mahlokohla Street Mbabane
F.3.4.2 OPENING OF BID SUBMISSIONS	Delete the following: "number of points claimed for BBEE status level"
F.3.5 TWO-ENVELOPE SYSTEM	A two-envelope procedure will <b>not</b> be followed.
F.3.5.2 TWO-ENVELOPE SYSTEM	Delete the following: "and any points claimed for BBEE status level"
F.3.9 F.3.9.1	Replace the contents of the clause with the following:

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Clause number	Data																				
ARITHMETICAL ERRORS	<p>“Check responsive tender offers for arithmetical errors, correcting them in the following manner:</p> <p>a) Where there is a discrepancy between the amounts in figures and in words, the amount in words shall govern.</p> <p>b) If bills of quantities (or schedule of quantities or schedule of rates) apply and there is an error in the line item total resulting from the product of the unit rate and the quantity, <u>the rate shall govern and the line item total shall be corrected.</u></p> <p>c) Where there is an error in the total of the prices either as a result of corrections required by this checking process or in the tenderer's addition of prices, the total of the prices shall be adjusted to reflect the arithmetically correct summation of corrected line item totals.</p> <p>Consider the rejection of a tender offer if the tenderer does not accept the correction of the arithmetical errors in the manner described above.”</p>																				
F.3.11 EVALUATION OF BID OFFERS	<p>Tender evaluation <b>Method 2</b> as described in F.3.11.3 will be used.</p> <p>Technical and costing criteria will be evaluated based on a 70% for quality and 30% for the financial offer. Technical and general criteria will be evaluated in terms of <b>Part T2</b>.</p>																				
F.3.11.2 EVALUATION OF BID OFFERS	<p>Delete the following:</p> <p>“score point for BBEE status”</p>																				
F.3.11.3 EVALUATION OF BID OFFERS	<p>No preference scoring will be done.</p> <p>Delete the following paragraphs:</p> <p>“4(a), 4(d), 5(b), 5(d)”.</p>																				
F.3.11.5 SCORING FINANCIAL OFFERS	<p>Score the financial offers of remaining responsive tender offers using the following formula:</p> <p>W1 is the maximum possible number of tender evaluation points awarded for price as stated in the Tender Data = 30%</p> <table><tr><td>N<sub>FO</sub></td><td>= W, x A where:</td></tr><tr><td>N<sub>FO</sub></td><td>= the number of tender evaluation points awarded for the financial offer.</td></tr><tr><td>W<sub>1</sub></td><td>= the maximum possible number of tender evaluation points awarded for the financial offer as stated in the Tender Data.</td></tr><tr><td>A</td><td>= a number calculated using either formulas 1 or 2 below as stated in the Tender Data.</td></tr></table> <p>The financial offer will be scored using Formula 2 (option 1) in Table F.1.</p> <p><b>Table F.1: Formulae for calculating the value of A</b></p> <table><tr><th>Formula</th><th>Comparison aimed at achieving</th><th>Option 1</th><th>Option 2</th></tr><tr><td>1</td><td>Highest price or discount</td><td><math>A = (1 + \frac{P - P_m}{P_m})</math></td><td><math>A = P / P_m</math></td></tr><tr><td>2</td><td>Lowest price or percentage commission/fee</td><td><math>A = (1 - \frac{P - P_m}{P_m})</math></td><td><math>A = P_m / P</math></td></tr></table>	N <sub>FO</sub>	= W, x A where:	N <sub>FO</sub>	= the number of tender evaluation points awarded for the financial offer.	W <sub>1</sub>	= the maximum possible number of tender evaluation points awarded for the financial offer as stated in the Tender Data.	A	= a number calculated using either formulas 1 or 2 below as stated in the Tender Data.	Formula	Comparison aimed at achieving	Option 1	Option 2	1	Highest price or discount	$A = (1 + \frac{P - P_m}{P_m})$	$A = P / P_m$	2	Lowest price or percentage commission/fee	$A = (1 - \frac{P - P_m}{P_m})$	$A = P_m / P$
N <sub>FO</sub>	= W, x A where:																				
N <sub>FO</sub>	= the number of tender evaluation points awarded for the financial offer.																				
W <sub>1</sub>	= the maximum possible number of tender evaluation points awarded for the financial offer as stated in the Tender Data.																				
A	= a number calculated using either formulas 1 or 2 below as stated in the Tender Data.																				
Formula	Comparison aimed at achieving	Option 1	Option 2																		
1	Highest price or discount	$A = (1 + \frac{P - P_m}{P_m})$	$A = P / P_m$																		
2	Lowest price or percentage commission/fee	$A = (1 - \frac{P - P_m}{P_m})$	$A = P_m / P$																		

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Clause number	Data														
	<p>where:</p> <p><math>P_m</math> = the comparative offer of the most favourable tender offer.  <math>P</math> = the comparative offer of tender offer under consideration.</p>														
F 3.11.7 EVALUATION OF TENDER OFFER	<p><math>W_2</math> is the maximum possible number of tender evaluation points awarded for the quality as stated in the tender data = 70%</p> <p>The quality criteria and maximum score in respect of each of the criteria are as follows:</p> <table border="1"> <thead> <tr> <th>Quality criteria</th><th>Maximum number of points</th></tr> </thead> <tbody> <tr> <td>Experience of Tenderer on similar projects</td><td>35</td></tr> <tr> <td>Delivery of previous projects (reference letters)</td><td>20</td></tr> <tr> <td>Key personnel proposed for the project</td><td>20</td></tr> <tr> <td>Construction equipment available for the project</td><td>10</td></tr> <tr> <td>Bank rating</td><td>15</td></tr> <tr> <td><b>Maximum possible score for quality (<math>M_s</math>)</b></td><td><b>100</b></td></tr> </tbody> </table> <p>The minimum number of evaluation points for quality is <b>75</b>.</p> <p>Score quality (functionality) in each of the categories in accordance with the Tender Data and calculate total score for quality.</p> <p>(completions of the tables from top of page 31 onwards will be used for evaluation)</p>	Quality criteria	Maximum number of points	Experience of Tenderer on similar projects	35	Delivery of previous projects (reference letters)	20	Key personnel proposed for the project	20	Construction equipment available for the project	10	Bank rating	15	<b>Maximum possible score for quality (<math>M_s</math>)</b>	<b>100</b>
Quality criteria	Maximum number of points														
Experience of Tenderer on similar projects	35														
Delivery of previous projects (reference letters)	20														
Key personnel proposed for the project	20														
Construction equipment available for the project	10														
Bank rating	15														
<b>Maximum possible score for quality (<math>M_s</math>)</b>	<b>100</b>														
F3.11.7 EVALUATION OF TENDER OFFER	<p>Financial offer and quality.</p> $T_{EV} = W_1 \times N_{FO} + W_2 \times N_Q$ <p>where:</p> <p><math>T_{EV}</math> is the total number of tender evaluation points  <math>N_{FO}</math> is the number of tender evaluation points awarded for the financial offer made in accordance with F.3.11.5 and <math>W_1</math> is 30;  <math>N_Q</math> is the number of tender evaluation points awarded for the quality offer made in accordance with F3.11.7 and <math>W_2</math> is 70;</p>														
F.3.13.1 ACCEPTANCE OF BID OFFER	<p>Bids containing any one or more of the errors or omissions, or bids not having complied with any one of the peremptory bid conditions as detailed on pages 2 &amp; 3 (Very Important Notice On Disqualification) of this bid document, shall not be considered and shall automatically be rejected.</p>														
F.3.16.1	<p>Add the following:</p> <p>“Before awarding a tender an intention to award will be sent and published on the SPPRA website at least 10 days before the contract award”</p>														

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Clause number	Data
F.3.18 PROVIDE COPIES OF THE CONTRACTS	The number of paper copies of the signed contract to be provided by the Employer is <b>one</b> .
F.3.19.1	Where stated in the section, amend to read: "CIDB or SPPRA"
ADDITIONAL CONDITIONS APPLICABLE TO THIS BID	<p>The additional conditions of bid are:</p> <ol style="list-style-type: none"> <li>1 The Employer/Engineer may also request that the bidder provide written evidence that his financial, labour and other resources are adequate for carrying out the contract.</li> <li>2 The Employer reserves the right to appoint a firm of chartered accountants and auditors and/or execute any other financial investigations on the financial resources of any bidder. The bidder shall provide all reasonable assistance in such investigations.</li> <li>3 The Employer may appoint more than one Contractor on this project, subject to the specific conditions agreed to in the Form of Acceptance.</li> <li>4 The bid document shall be submitted as a whole and shall <b>not</b> be taken apart.</li> <li>5 <b>List of returnable documents (PART T2) must be completed in full.</b> (A bidder's company profile <b>will not</b> be used by the MCM to complete PART T2 on behalf of the bidder)</li> </ol> <p><b>NB: If PART T2 is not completed in full by the bidder, this offer will be rejected.</b></p>
ADDITIONAL CONDITIONS APPLICABLE TO THIS BID	<p>The additional conditions of bid are:</p> <ol style="list-style-type: none"> <li>1 Bidders are requested to indicate whether or not their firm/company is an Approved or Accredited Installation Contractor</li> <li>2 The successful bidder is to be aware of the presence of landfill gas on the operational landfill and has taken all necessary precautions when repairing the liner.</li> </ol>

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**Annex F**  
(Normative)  
**Standard Conditions of Tender**

As published in Annexure F of the CIDB Standard for Uniformity for construction Procurement, Board Notice 136 Government Gazette No 38960 of 10 July 2015

**F.1 General**

**F.1.1 Actions**

The employer and each tenderer submitting a tender offer shall comply with these conditions of tender. In their dealings with each other, they shall discharge their duties and obligations as set out in F.2 and F.3, timeously and with integrity, and behave equitably, honestly and transparently, comply with all legal obligations and not engage in anticompetitive practices.

**F.1.1.1** The employer and the tenderer and all their agents and employees involved in the tender process shall avoid conflicts of interest and where a conflict of interest is perceived or known, declare any such conflict of interest, indicating the nature of such conflict. Tenderers shall declare any potential conflict of interest in their tender submissions. Employees, agents and advisors of the employer shall declare any conflict of interest to whoever is responsible for overseeing the procurement process at the start of any deliberations relating to the procurement process or as soon as they become aware of such conflict, and abstain from any decisions where such conflict exists or recuse themselves from the procurement process, as appropriate.

*Note: 1) A conflict of interest may arise due to a conflict of roles which might provide an incentive for improper acts in some circumstances. A conflict of interest can create an appearance of impropriety that can undermine confidence in the ability of that person to act properly in his or her position even if no improper acts result.*

*2) Conflicts of interest in respect of those engaged in the procurement process include direct, indirect or family interests in the tender or outcome of the procurement process and any personal bias, inclination, obligation, allegiance or loyalty which would in any way affect any decisions taken.*

**F.1.1.2** The employer shall not seek and a tenderer shall not submit a tender without having a firm intention and the capacity to proceed with the contract.

**F.1.2 Tender Documents**

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

**F.1.3 Interpretation**

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

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

**F.1.3.3** For the purposes of these conditions of tender, the following definitions apply:

a) **conflict of interest** means any situation in which:

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- i) someone in a position of trust has competing professional or personal interests which make it difficult to fulfill his or her duties impartially;
  - ii) an individual or organization is in a position to exploit a professional or official capacity in some way for their personal or corporate benefit; or
  - iii) Incompatibility or contradictory interests exist between an employee and the organization which employs that employee.
- b) **comparative** offer means the price after the factors of a non-firm price and all unconditional discounts it can be utilised to have been taken into consideration;
- c) **corrupt practice** means the offering, giving, receiving or soliciting of anything of value to influence the action of the employer or his staff or agents in the tender process;
- d) **fraudulent practice** means the misrepresentation of the facts in order to influence the tender process or the award of a contract arising from a tender offer to the detriment of the employer, including collusive practices intended to establish prices at artificial levels;
- e) **organization** means a company, firm, enterprise, association or other legal entity, whether incorporated or not, or a public body;
- f) **functionality** means the measurement according to the predetermined norms of a service or commodity designed to be practical and useful, working or operating, taking into account quality, reliability, viability and durability of a service and technical capacity and ability of a tenderer.

#### F.1.4 Communication and employer's agent

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

#### F.1.5 Cancellation and Re-Invitation of Tenders

**F.1.5.1** An organ of state may, prior to the award of the tender, cancel a tender if-

- a) due to changed circumstances, there is no longer a need for the services, works or goods requested; or
- b) funds are no longer available to cover the total envisaged expenditure; or
- c) no acceptable tenders are received.

**F.1.5.2** The decision to cancel a tender must be published in the CIDB website and in the government Tender Bulletin for the media in which the original tender invitation was advertised.

#### F.1.6 Procurement procedures

##### F.1.6.1 General

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Unless otherwise stated in the tender data, a contract will, subject to F.3.13, be concluded with the tenderer who in terms of F.3.11 is the highest ranked or the tenderer scoring the highest number of tender evaluation points, as relevant, based on the tender submissions that are received at the closing time for tenders.

#### **F.1.6.2 Competitive negotiation procedure**

F1.6.2.1 Where the tender data require that the competitive negotiation procedure is to be followed, tenderers shall submit tender offers in response to the proposed contract in the first round of submissions. Notwithstanding the requirements of F.3.4, the employer shall announce only the names of the tenderers who make a submission. The requirements of F.3.8 relating to the material deviations or qualifications which affect the competitive position of tenderers shall not apply.

F1.6.2.2 All responsive tenderers, or not less than three responsive tenderers that are highest ranked in terms of the evaluation method and evaluation criteria stated in the tender data, shall be invited in each round to enter into competitive negotiations, based on the principle of equal treatment and keeping confidential the proposed solutions and associated information. Notwithstanding the provisions of F.2.17, the employer may request that tenders be clarified, specified and fine-tuned in order to improve a tenderer's competitive position provided that such clarification, specification, fine-tuning or additional information does not alter any fundamental aspects of the offers or impose substantial new requirements which restrict or distort competition or have a discriminatory effect.

F1.6.2.3 At the conclusion of each round of negotiations, tenderers shall be invited by the employer to make a fresh tender offer, based on the same evaluation criteria, with or without adjusted weightings. Tenderers shall be advised when they are to submit their best and final offer.

F1.6.2.4 The contract shall be awarded in accordance with the provisions of F.3.11 and F.3.13 after tenderers have been requested to submit their best and final offer.

#### **F.1.6.3 Proposal procedure using the two stage-system**

##### **F1.6.3.1 Option 1**

Tenderers shall in the first stage submit technical proposals and, if required, cost parameters around which a contract may be negotiated. The employer shall evaluate each responsive submission in terms of the method of evaluation stated in the tender data, and in the second stage negotiate a contract with the tenderer scoring the highest number of evaluation points and award the contract in terms of these conditions of tender.

##### **F1.6.3.2 Option 2**

F1.6.3.2.1 Tenderers shall submit in the first stage only technical proposals. The employer shall invite all responsive tenderers to submit tender offers in the second stage, following the issuing of procurement documents.

F1.6.3.2.2 The employer shall evaluate tenders received during the second stage in terms of the method of evaluation stated in the tender data, and award the contract in terms of these conditions of tender.

## **F.2 Tenderer's obligations**

### **F.2.1 Eligibility**

F.2.1.1 Submit a tender offer only if the tenderer satisfies the criteria stated in the tender data and the tenderer, or any of his principals, is not under any restriction to do business with employer.

F.2.1.2 Notify the employer of any proposed material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used by the employer as the basis in

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a prior process to invite the tenderer to submit a tender offer and obtain the employer's written approval to do so prior to the closing time for tenders.

## **F.2.2 Cost of tendering**

**F2.2.1** Accept that, unless otherwise stated in the tender data, the employer will not compensate the tenderer for any costs incurred in the preparation and submission of a tender offer, including the costs of any testing necessary to demonstrate that aspects of the offer complies with requirements.

**F2.2.2** The cost of the tender documents charged by the employer shall be limited to the actual cost incurred by the employer for printing the documents. Employers must attempt to make available the tender documents on its website so as not to incur any costs pertaining to the printing of the tender documents.

## **F.2.3 Check documents**

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

## **F.2.4 Confidentiality and copyright of documents**

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

## **F.2.5 Reference documents**

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

## **F.2.6 Acknowledge addenda**

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

## **F.2.7 Clarification meeting**

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

## **F.2.8 Seek clarification**

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

## **F.2.9 Insurance**

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

## **F.2.10 Pricing the tender offer**

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

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

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

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

**F.2.11 Alterations to documents**

Do not make any alterations or additions to the tender documents, except to comply with instructions issued by the employer, or necessary to correct errors made by the tenderer. All signatories to the tender offer shall initial all such alterations.

**F.2.12 Alternative tender offers**

**F.2.12.1** Unless otherwise stated in the tender data, submit alternative tender offers only if a main tender offer, strictly in accordance with all the requirements of the tender documents, is also submitted as well as a schedule that compares the requirements of the tender documents with the alternative requirements that are proposed.

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

**F.2.12.3** An alternative tender offer may only be considered in the event that the main tender offer is the winning tender.

**F.2.13 Submitting a tender offer**

**F.2.13.1** Submit one tender offer only, either as a single tendering entity or as a member in a joint venture to provide the whole of the works, services or supply identified in the contract data and described in the scope of works, unless stated otherwise in the tender data.

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

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

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

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

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

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

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

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**F.2.13.9** Accept that tender offers submitted by facsimile or e-mail will be rejected by the employer, unless stated otherwise in the tender data.

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

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

**F.2.15 Closing time**

**F.2.15.1** Ensure that the employer receives the tender offer at the address specified in the tender data not later than the closing time stated in the tender data. Accept that proof of posting shall not be accepted as proof of delivery.

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

**F.2.16 Tender offer validity**

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

**F.2.16.2** If requested by the employer, consider extending the validity period stated in the tender data for an agreed additional period with or without any conditions attached to such extension.

**F.2.16.3** Accept that a tender submission that has been submitted to the employer may only be withdrawn or substituted by giving the employer's agent written notice before the closing time for tenders that a tender is to be withdrawn or substituted.

**F.2.16.4** Where a tender submission is to be substituted, submit a substitute tender in accordance with the requirements of F.2.13 with the packages clearly marked as "SUBSTITUTE".

**F.2.17 Clarification of tender offer after submission**

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

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

**F.2.18 Provide other material**

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

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

**F.2.19 Inspections, tests and analysis**

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

#### **F.2.20 Submit securities, bonds and policies**

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

#### **F.2.21 Check final draft**

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

#### **F.2.22 Return of other tender documents**

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

#### **F.2.23 Certificates**

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

### **F.3 The employer's undertakings**

#### **F.3.1 Respond to requests from the tenderer**

**F.3.1.1** Unless otherwise stated in the tender Data, respond to a request for clarification received up to five working days before the tender closing time stated in the Tender Data and notify all tenderers who drew procurement documents.

**F.3.1.2** Consider any request to make a material change in the capabilities or formation of the tendering entity (or both) or any other criteria which formed part of the qualifying requirements used to prequalify a tenderer to submit a tender offer in terms of a previous procurement process and deny any such request if as a consequence:

- a) an individual firm, or a joint venture as a whole, or any individual member of the joint venture fails to meet any of the collective or individual qualifying requirements;
- b) the new partners to a joint venture were not prequalified in the first instance, either as individual firms or as another joint venture; or
- c) in the opinion of the Employer, acceptance of the material change would compromise the outcome of the prequalification process.

#### **F.3.2 Issue Addenda**

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

#### **F.3.3 Return late tender offers**

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

#### **F.3.4 Opening of tender submissions**

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

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**F.3.4.2** Announce at the meeting held immediately after the opening of tender submissions, at a venue indicated in the tender data, the name of each tenderer whose tender offer is opened and, where applicable, the total of his prices, number of points claimed for its BBBEE status level and time for completion for the main tender offer only.

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

### **F.3.5 Two-envelope system**

**F.3.5.1** Where stated in the tender data that a two-envelope system is to be followed, open only the technical proposal of valid tenders in the presence of tenderers' agents who choose to attend at the time and place stated in the tender data and announce the name of each tenderer whose technical proposal is opened.

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

### **F.3.6 Non-disclosure**

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

### **F.3.7 Grounds for rejection and disqualification**

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

### **F.3.8 Test for responsiveness**

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

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

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

- a) detrimentally affect the scope, quality, or performance of the works, services or supply identified in the Scope of Work,
- b) significantly change the Employer's or the tenderer's risks and responsibilities under the contract, or
- c) affect the competitive position of other tenderers presenting responsive tenders, if it were to be rectified.

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

### **F.3.9 Arithmetical errors, omissions and discrepancies**

**F.3.9.1** Check the highest ranked tender or tenderer with the highest number of tender evaluation points after the evaluation of tender offers in accordance with F.3.11 for:

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- a) the gross misplacement of the decimal point in any unit rate;
- b) omissions made in completing the pricing schedule or bills of quantities; or
- c) arithmetic errors in:
  - i) line item totals resulting from the product of a unit rate and a quantity in bills of quantities or schedules of prices; or
  - ii) the summation of the prices.

**F.3.9.2** The employer must correct the arithmetical errors in the following manner:

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

Consider the rejection of a tender offer if the tenderer does not correct or accept the correction of the arithmetical error in the manner described above.

#### **F.3.10 Clarification of a tender offer**

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

#### **F.3.11 Evaluation of tender offers**

##### **F.3.11.1 General**

Appoint an evaluation panel of not less than three persons. Reduce each responsive tender offer to a comparative offer and evaluate them using the tender evaluation methods and associated evaluation criteria and weightings that are specified in the tender data.

##### **F.3.11.2 Method 1: Price and Preference**

In the case of a price and preference:

- 1) Score tender evaluation points for price
- 2) Score points for BBBEE contribution
- 3) Add the points scored for price and BBBEE.

##### **F.3.11.3 Method 2: Functionality, Price and Preference**

In the case of a functionality, price and preference:

- 1) Score functionality, rejecting all tender offers that fail to achieve the minimum number of points for functionality as stated in the Tender Data.
- 2) No tender must be regarded as an acceptable tender if it fails to achieve the minimum qualifying score for functionality as indicated in the tender invitation.

#### **BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....  
2. ....

**Witness:** .....

#### **MCM:**

**Initial:** MCM .....



- 3) Tenders that have achieved the minimum qualification score for functionality must be evaluated further in terms of the preference points system prescribed in paragraphs 4 and 4 and 5 below.

The 80/20 preference point system for acquisition of services, works or goods up to Rand value of R1 million

- (4)(a)(i) The following formula must be used to calculate the points for price in respect of tenders( including price quotation) with a rand value equal to, or above R 30 000 and up to Rand value of R 1 000 000 ( all applicable taxes included):

$$P_s = 80 \times \left(1 - \frac{(P_t - P_{min})}{P_{min}}\right)$$

Where

$P_s$  = Points scored for comparative price of tender or offer under consideration;

$P_t$  = Comparative price of tender or offer under consideration; and

$P_{min}$  = Comparative price of lowest acceptable tender or offer.

- (4)(a)(ii) An employer of state may apply the formula in paragraph (i) for price quotations with a value less than R30 000, if and when appropriate:
- (4)(b) Subject to subparagraph(4)(c), points must be awarded to a tender for attaining the B-BBEE status level of contributor in accordance with the table below:

B-BBEE status level of contributor	Number of points
1	20
2	18
3	16
4	12
5	8
6	6
7	4
8	2
Non-compliant contributor	0

- (4)(c) A maximum of 20 points may be allocated in accordance with subparagraph (4)(b)
- (4)(d) The points scored by tender in respect of B-BBEE contribution contemplated in contemplated in subparagraph (4) (b) must be added to the points scored for price as calculated in accordance with subparagraph (4)(a)
- (4)(e) Subject to paragraph 4.3.8<sup>1</sup> the contract must be awarded to the tender who scores the highest total number of points.

**The 90/ 10 preference points system for acquisition of services, works or goods with a Rand value above R 1 million**

<sup>1</sup> Standard for Uniformity In Construction Procurement July, 2015.

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



- (5)(a) The following formula must be used to calculate the points for price in respect of tenders with a Rand value above R1 000 000 (all applicable taxes included):

$$P_s = 90 \times \left(1 - \frac{(P_t - P_{min})}{P_{min}}\right)$$

Where

$P_s$  = Points scored for comparative price of tender or offer under consideration;

$P_t$  = Comparative price of tender or offer under consideration; and

$P_{min}$  = Comparative price of lowest acceptable tender or offer.

- (5)(b) Subject to subparagraph(5)(c), points must be awarded to a tender for attaining the B- BBEE status level of contributor in accordance with the table below:

B-BBEE status level of contributor	Number of points
1	10
2	9
3	8
4	5
5	4
6	3
7	2
8	1
Non-compliant contributor	0

- (5)(c) A maximum of 10 points may be allocated in accordance with subparagraph (5)(b).

- (5)(d) The points scored by tender in respect of B-BBEE contribution contemplated in contemplated in subparagraph (5) (b) must be added to the points scored for price as calculated in accordance with subparagraph (5)(a).

- (5)(e) Subject to paragraph 4.3.8<sup>2</sup> the contract must be awarded to the tender who scores the highest total number of points.

#### F.3.11.4 Decimal places

Score price, preference and functionality, as relevant, to two decimal places.

#### F.3.11.5 Scoring Price

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

<sup>2</sup> Standard for Uniformity In Construction Procurement July, 2015.

#### **BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

#### **MCM:**

**Initial:** MCM .....



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

where:  $N_{FO}$  is the number of tender evaluation points awarded for price.  
 $W_1$  is the maximum possible number of tender evaluation points awarded for price as stated in the Tender Data.  
 $A$  is a number calculated using the formula and option described in Table F.1 as stated in the Tender Data.

**Table F.1: Formulae for calculating the value of A**

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

where:

$P_m$  = the comparative offer of the most favourable tender offer.  
 $P$  = the comparative offer of tender offer under consideration.

#### F.3.11.6 Scoring preferences

Confirm that tenderers are eligible for the preferences claimed in accordance with the provisions of the tender data and reject all claims for preferences where tenderers are not eligible for such preferences.

Calculate the total number of tender evaluation points for preferences claimed in accordance with the provisions of the tender data.

#### F.3.11.7 Scoring functionality

Score each of the criteria and sub-criteria for quality in accordance with the provisions of the Tender Data.

Calculate the total number of tender evaluation points for quality using the following formula:

$$N_Q = W_2 \times S_O / M_S$$

where:  $S_O$  is the score for quality allocated to the submission under consideration;  
 $M_S$  is the maximum possible score for quality in respect of a submission; and  
 $W_2$  is the maximum possible number of tender evaluation points awarded for the quality as stated in the tender data

#### F.3.12 Insurance provided by the employer

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

#### F.3.13 Acceptance of tender offer

Accept the tender offer, if in the opinion of the employer, it does not present any risk and only if the tenderer:

**BIDDER:**  
**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**  
**Initial:** MCM .....



- a) is not under restrictions, or has principals who are under restrictions, preventing participating in the employer's procurement,
- b) can, as necessary and in relation to the proposed contract, demonstrate that he or she possesses the professional and technical qualifications, professional and technical competence, financial resources, equipment and other physical facilities, managerial capability, reliability, experience and reputation, expertise and the personnel, to perform the contract,
- c) has the legal capacity to enter into the contract,
- d) is not insolvent, in receivership, under Business Rescue as provided for in chapter 6 of the Companies Act, 2008, bankrupt or being wound up, has his affairs administered by a court or a judicial officer, has suspended his business activities, or is subject to legal proceedings in respect of any of the foregoing,
- e) complies with the legal requirements, if any, stated in the tender data, and
- f) is able, in the opinion of the employer, to perform the contract free of conflicts of interest.

#### **F.3.14 Prepare contract documents**

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

- a) addenda issued during the tender period,
- b) inclusion of some of the returnable documents, and
- c) other revisions agreed between the employer and the successful tenderer.

**F.3.14.1** Complete the schedule of deviations attached to the form of offer and acceptance, if any.

#### **F.3.15 Complete adjudicator's contract**

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

#### **F.3.16 Notice to unsuccessful tenderers**

**F.3.16.1** Notify the successful tenderer of the employer's acceptance of his tender offer by completing and returning one copy of the form of offer and acceptance before the expiry of the validity period stated in the tender data, or agreed additional period.

**F.3.16.2** After the successful tenderer has been notified of the employer's acceptance of the tender, notify other tenderers that their tender offers have not been accepted.

#### **F.3.17 Provide copies of the contracts**

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

#### **F.3.18 Provide written reasons for actions taken**

Provide upon request written reasons to tenderers for any action that is taken in applying these conditions of tender, but withhold information which is not in the public interest to be divulged, which is considered to prejudice the legitimate commercial interests of tenderers or might prejudice fair competition between tenderers.

#### **F.3.19 Transparency in the procurement process**

##### **BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

##### **MCM:**

**Initial:** MCM .....



**F.3.19.1** The CIDB prescripts require that tenders must be advertised and be registered on the CIDB i.Tender system.

**F.3.19.2** The employer must adopt a transparency model that incorporates the disclosure and accountability as transparency requirements in the procurement process.

**F.3.19.3** The transparency model must identify the criteria for selection of projects, project information template and the threshold value of the projects to be disclosed in the public domain at various intervals of delivery of infrastructure projects.

**F.3.19.4** The client must publish the information on a quarterly basis which contains the following information:

- Procurement planning process
- Procurement method and evaluation process
- Contract type
- Contract status
- Number of firms tendering
- Cost estimate
- Contract title
- Contract firm(s)
- Contract price
- Contract scope of work
- Contract start date and duration
- Contract evaluation reports

**F.3.19.5** The employer must establish a Consultative Forum which will conduct a random audit in the implementation of the transparency requirements in the procurement process.

**F.3.19.6** Consultative Forum must be an independent structure from the bid committees.

**F.3.19.7** The information must be published on the employer's website.

**F.3.19.8** Records of such disclosed information must be retained for audit purposes.

**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**

**Initial:** MCM .....



**MUNICIPAL COUNCIL OF MBABANE**

DEPARTMENT NAME: **TECHNICAL SERVICES**

**Tender No: 31-2018/2019**

FOR

**REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER**

**PART T2 LIST OF RETURNABLE DOCUMENTS**

*The bidder must complete the following returnable documents.*

- T2.1 RETURNABLE SCHEDULES REQUIRED FOR BID  
EVALUATION PURPOSES .....
- T2.2 OTHER DOCUMENTS REQUIRED FOR BID  
EVALUATION PURPOSES .....
- T2.3 RETURNABLE SCHEDULES THAT WILL BE INCORPORATED  
IN THE CONTRACT .....

**NOTE:**

Although the documents under Part T2 is headed "Returnable Documents" in line with the CIDB model, these are not the only documents to be returned together with the bid. **All** the documents indicated on Part T1, must be completed and signed where applicable and submitted as a **complete set of documents**.

**BIDDER:**  
**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**  
**Initial:** MCM .....

## **T2.1 RETURNABLE SCHEDULES REQUIRED FOR BID EVALUATION PURPOSES**

<b><u>CONTENTS</u></b>	<b><u>PAGE(S)</u></b>
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FORM 2.1.3: STAFFING PROFILE.....	35
FORM 2.1.4: PROPOSED KEY PERSONNEL .....	35
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**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....





## **FORM 2.1.1 SCHEDULE OF CONSTRUCTION**

The Bidder shall state below what Construction Equipment will be available for the work should he be awarded the Contract.

DESCRIPTION, SIZE, CAPACITY	NUMBER

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



DESCRIPTION, SIZE, CAPACITY	NUMBER

**BIDDER:**  
**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**  
**Initial:** MCM .....



**FORM 2.1.2      SIZE OF ENTERPRISE AND CURRENT WORKLOAD**

What was your turnover in the previous financial year?      R\_\_\_\_\_

What is the estimated turnover for your current financial year?      R\_\_\_\_\_

Physical facilities:

Provide information on offices, factories, yards and warehouses occupied by your enterprise (attach details if the space provided is not enough)

Description	Address	Area (m <sup>2</sup> )

List your current contracts and obligations:

Description	Value (E)	Start date	Duration	Expected completed date

Do you have the capacity to supply the goods and services described in this bid, should the contract be awarded to you?

\_\_\_\_\_

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



**FORM 2.1.3 STAFFING PROFILE**

Provide information on the staff that you have available to execute this contract (attach a separate list if the space provided is insufficient)

Own staff: gender and race	Number of staff
Staff to be employed for the project: gender and race	Number of staff

**FORM 2.1.4 PROPOSED KEY PERSONNEL**

The Bidder shall list below the key personnel (including first nominee and the second choice alternate), whom he proposes to employ on the project should his Bid be accepted, both at his headquarters and on the Site, to direct and for the execution of the work, together with their qualifications, experience, positions held and their nationalities. (Please add proof of qualifications)

DESIGNATION	NAME OF	NATIONALITY:	SUMMARY OF		HDI Status Yes/No	NQF 7 Certified Yes/No
	(i) NOMINEE (ii) ALTERNATE		QUALIFICATIONS	EXPERIENCE AND PRESENT OCCUPATION		
<u>HEADQUARTERS</u> Partner/director						

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



Project manager						
Other key staff (give designation)						
ONSTRUCTION MONITORING Site Agent						
Engineer on Site						
Construction supervisor (give designation)						
Other key staff (give designation)						

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



**FORM 2.1.5      SCHEDULE OF PREVIOUS WORK CARRIED OUT BY BIDDER**

Provide the following information on **relevant previous experience**. Indicate comparable projects of similar or larger size. This information is material to the award of the Contract.

**No points will be awarded if reference cannot be reached or if it refuses to supply information. Give at least two (2) names and telephone numbers and e-mail address per reference.**

<b>EMPLOYER</b> (Name, tel no and fax no)	<b>CONSULTING ENGINEER</b> (Name, tel no and fax no)	<b>NATURE OF WORK CARRIED OUT PREVIOUSLY</b>	<b>VALUE OF WORK</b>	<b>YEAR OF COMPLETION</b>

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



The scoring of the tenderer's experience will be as follows:

<b>Poor (score 40)</b>	Tenderer has limited experience
<b>Satisfactory (score 70)</b>	Tenderer has relevant experience but has not dealt with the critical issues specific to the assignment.
<b>Good (score 90)</b>	Tenderer has extensive experience in relation to the project and has worked previously under similar conditions and circumstances.
<b>Very good (score 100)</b>	Tenderer has outstanding experience in projects of a similar nature.

The undersigned, who warrants that he / she is duly authorised to do so on behalf of the enterprise, confirms that the contents of this schedule are within my personal knowledge and are to the best of my belief both true and correct.

Signed

Date

Name

Position

Tenderer

## FORM 2.1.6 FINANCIAL ABILITY TO EXECUTE THE PROJECT

Provide details on the surety you will provide if the bid is awarded to you

(AMOUNT)

Which of the following institutions will provide surety?

- Bank registered in terms of the RSA, Bank Act 1990 (Act 94 of 1990) or the Swaziland Financial Act 2005 (Act 6 of 2005):

- Insurance Company registered in terms of the RSA, Short Term Insurance Act 1998 (Act 53 of 1998) or the Swaziland Insurance Act 2005 (Act 7 of 2005):

- Cash: \_\_\_\_\_

Provide the estimated cash flow on the project in terms of submissions of payment certificates or payment schedules to the Employer

Month no	Amount (VAT included)
----------	-----------------------

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



	a Received	b Payments made	a – b Net cash flow	Cumulative cash flow
1			d	j=d
2			e	j+e=k
			f	k+f=l
			g	l+g=m
5			h	m+h=n
6			Etc.	Etc.
7				
8				
9				
10				
Maximum negative cash flow: Take the largest negative number in the last column and write it in here → → → → → → →				

**Notes:**

- (i) Value added tax to be included in all amounts
- (ii) Assume payment of certificates within 30 days of approval of certificate

From what sources will you fund the above amount (e.g. Funds internally available, bank overdraft, loan, etc)

---



---

**FORM 2.1.7 AUTHORITY FOR SIGNATORY**

All signatories, including sole proprietors, shall confirm their authority by attaching to the last page of this bid a duly signed and ***dated original or certified copy*** of the relevant resolution of their members or their board of directors, as the case may be.

**An example for “COMPANIES / PARTNERSHIPS / CLOSE CORPORATIONS is shown below:**

"By resolution of the board of directors passed on 15 January 2016, Mr A. APPLE has been duly authorised to sign all documents in connection with the Bid for Contract number RTCW 10/2016 and any Contract, which may arise there from on behalf of the Bidding Entity, namely, “ABCD (PTY) LTD”

SIGNED ON BEHALF OF THE BIDDING ENTITY: B.J. JONES

IN HIS CAPACITY AS: DIRECTOR / PARTNER / MEMBER

DATE: 15 January 2016

AUTHORISED PERSON'S SIGNATURE: A. APPLE

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....





AS WITNESS: 1. B. XABA

**An example for “JOINT VENTURES” is shown below:**

We, the undersigned are submitting this bid offer in Joint Venture and hereby authorize Mr. B. BROOK, authorised signatory of the company “ABCD (PTY) LTD”, acting in the capacity of lead partner, to sign all documents in connection with the bid for Contract number RTCW 10/2016 and any contract resulting from it on our behalf.

NAME OF FIRM	ADDRESS	DULY AUTHORIZED SIGNATORY
(Lead partner, i.e. “ <u>ABCD (PTY) LTD</u> ”)	P.O. Box 111 Springs 1560	Signature:..... Name:..... Designation:.....
Name of 2 <sup>nd</sup> Company	Address of 2 <sup>nd</sup> Company	Signature:..... Name:..... Designation:.....
Name of 3 <sup>rd</sup> Company	Address of 3 <sup>rd</sup> Company	Signature:..... Name:..... Designation:.....

**An example for “SOLE PROPRIETOR” is shown below:**

“I hereby certify that I’m the sole proprietor of the Bidding Entity, namely, “MACADOO” and therefore duly authorised to sign the bidding documents”

SIGNATURE OF SOLE PROPRIETOR: B.J. JONES

IN HIS CAPACITY AS: SOLE PROPRIETOR

DATE: 15 January 2016

AUTHORISED PERSON’S SIGNATURE: B.J. JONES

AS WITNESS: 1. B. XABA

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



**FORM 2.1.8****SCHEDULE OF PROPOSED SUBCONTRACTORS**

Provide details on all sub-contractors you intend utilising for this contract

Type of work to be used for	a % of contract	Name of sub-contractor	b % HDI owner-ship	c = a x b Total contribution to HDI ownership
Total % of contract sub-contracted			Total contribution of HDI ownership:	

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



**FORM 2.1.9****FINANCIAL REFERENCES****FINANCIAL STATEMENTS**

I/We agree, if required, to furnish an audited copy of the latest set of financial statements together with my/our Directors' and Auditors' report.

**DETAILS OF BIDDING ENTITY'S BANK**

If the bidder is a Joint Venture or partnership, the information requested below is required for each member / partner.

I/We hereby authorise the Employer/Engineer to approach all or any of the following banks for the purposes of obtaining a financial reference:

DESCRIPTION OF BANK DETAIL	BANK DETAILS APPLICABLE TO BIDDER
Name of bank	
Contact person	
Branch name	
Branch code	
Street address	
Postal address	
Telephone number	(     )
Fax number	(     )
Account number	
Type of account, (i.e. cheque account)	

**BIDDER'S TAX DETAILS**

Bidder's VAT vendor registration number: .....

Bidder's SARS/SRA tax reference number: .....

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



DESCRIPTION OF BANK DETAIL	BANK DETAILS APPLICABLE TO BIDDER
Name of bank	
Contact person	
Branch name	
Branch code	
Street address	
Postal address	
Telephone number	(     )
Fax number	(     )
Account number	
Type of account, (i.e. cheque account)	

### **BIDDER'S TAX DETAILS**

Bidder's VAT vendor registration number: .....

Bidder's SARS/SRA tax reference number: .....

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



**FORM 2.1.10      DETAILS OF ALTERNATIVE BIDS SUBMITTED**

See condition of bid.

DESCRIPTION

**FORM 2.1.11      AMENDMENTS AND QUALIFICATIONS BY BIDDER**

See condition of bid

PAGE	DESCRIPTION

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



**FORM 2.1.12 LABOUR-ENHANCED METHODS: PROPOSED PLANNED ACTIONS OF  
BIDDER RESULTING IN DEVIATIONS FROM SPECIFIED WORK**

ACTIVITY OR PAY ITEM	DESCRIPTION OF PLANNED ACTION RESULTING IN DEVIATION FROM SPECIFIED WORK

**Compliance with Employment Equity Act 55 of 1998**

Attach a valid certificate from the Department of Labour, or a declaration (refer to "Form 2.3.5 – Specific goals") by the **designated employer**, that the employer complies with the relevant chapters of the Employment Equity Act.

**Definitions in terms of the last mentioned Act.**

**"designated employer"** means-

- a) an employer who employs 50 or more employees;
- b) an employer who employs fewer than 50 employees, but has a total annual turnover that is equal to or above the applicable annual turnover of a small business in terms of Schedule 4 to this Act."

**"Schedule 4"**

**TURNOVER THRESHOLD APPLICABLE TO DESIGNATED EMPLOYERS**

Sector or sub sector in accordance with the Standard Industrial Classification	Total annual turnover
Agriculture	R 2,00 m
Mining and Quarrying	R 7,50 m
Manufacturing	R 10,00 m
Electricity, Gas and Water	R 10,00 m
Construction	R 5,00 m
Retail and Motor Trade and Repair Services	R 15,00 m
Wholesale Trade, Commercial Agents and Allied Services	R 25,00 m
Catering, Accommodation and other Trade	R 5,00 m
Transport, Storage and Communications	R 10,00 m
Finance and Business Services	R 10,00 m
Community, Social and Personal Services	R 5,00 m

**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**

**Initial:** MCM .....



## MUNICIPAL COUNCIL OF MBABANE

DEPARTMENT NAME: *TECHNICAL SERVICES*

### **Tender No: 31-2018/2019**

FOR

*REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER*

## **T2.2 OTHER DOCUMENTS REQUIRED FOR BID EVALUATION PURPOSES**

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**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



**FORM 2.2.1 CERTIFICATE OF BIDDER'S ATTENDANCE AT THE COMPULSORY SITE/CLARIFICATION MEETING**

This is to certify that I, **(NAME IN PRINT)** .....,  
representative of (Bidder) .....  
.....  
of (address) .....  
.....  
.....  
Telephone number .....  
Fax number .....  
visited and inspected the Site / Attended Clarification Meeting on (date) .....  
in the company of (Engineer/Engineer's Representative) .....  
  
SIGNATURE OF BIDDER'S REPRESENTATIVE: .....

**FORM 2.2.2 TAX COMPLIANCE CERTIFICATE**

ORIGINAL AND VALID TAX COMPLIANCE CERTIFICATE OR COPY THEREOF, OBTAINED FROM SRA/SARS  
TO BE SUBMITTED WITH BID DOCUMENTS. THE CERTIFICATE MUST NOT BE OLDER THAN 12 MONTHS.

**BIDDER:**  
**Initial:** Authorized signatory/ies: 1. ....  
2. ....  
**Witness:** .....

**MCM:**  
**Initial:** MCM .....





### **FORM 2.2.3 PROOF OF REGISTRATION WITH CONSTRUCTION INDUSTRY COUNCIL**

The bidder is to affix to this page either:

- Written proof of his registration with the CIC as a Category (xxxx).

Or

- Written proof of his application to the CIC for registration as a contractor in the category listed above.

Note:

1. Failure to affix such documentation as prescribed to this page shall result in this bid not being further considered for the award of the contract.
2. Should this bid be considered for award of the contract, based on proof of submission of application for registration in the appropriate category with the CIDB, and should proof of such subsequent registration not be forthcoming to the employer before the end of business, at the last working day, prior to evaluation by the Tender Evaluation Committee of the contract, then this bid will no longer be considered for the award of the contract.

### **FORM 2.2.4 ISO 14001 CERTIFICATE**

COPY OF THE BIDDER'S ISO 14001 ENVIRONMENTAL MANAGEMENT SYSTEM CERTIFICATION OF PROOF  
FROM SANS THAT COMPANY IS IN PROCESS FOR REGISTRATION

**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**

**Initial:** MCM .....



**FORM 2.2.5      DECLARATION:**

*I/We, the undersigned:*

- (a) *bid to supply and deliver to the MUNICIPAL COUNCIL OF MBABANE [hereafter "MCM"] all or any of the supplies and to render all or any of the articles, goods, materials, services or the like described both in this and the other Schedules to this Contract;*
- (b) *agree that we will be bound by the specifications, prices, terms and conditions stipulated in those Schedules attached to this bid document, regarding delivery and execution;*
- (c) *further agree to be bound by those conditions, set out in, "PARTS T1; T2; C1; C2; C3 and C4", attached hereto, should this bid be accepted in whole or in part;*
- (d) *confirm that this bid may only be accepted by the MCM by way of a duly authorised Letter of Acceptance;*
- (e) *declare that we are fully acquainted with the Bid document and Schedules, and the contents thereof and that we have signed the Bill of Quantities and completed the Returnable Schedules and declarations, attached hereto;*
- (f) *declare that all amendments to the bid document have been initialled by the relevant authorised person and that the document constitutes a proper contract between the MCM and the undersigned;*
- (g) *certify that the item/s mentioned in the bid document, qualifies/qualify for the preference(s) shown.;*
- (h) *acknowledge that the information furnished is true and correct;*
- (i) *accept that in the event of the contract being awarded as a result of preference claimed in this bid document, I may be required to furnish documentary proof to the satisfaction of the MCM that the claims are correct. If the claims are found to be inflated, the MCM may, in addition to any other remedy it may have, recover from me all cost, losses or damages incurred or sustained by the MCM as a result of the award of the contract and/or cancel the contract and claim any damages which the MCM may suffer by having to make less favourable arrangements after such cancellation;*
- (j) *declare that no municipal rates and taxes or municipal service charges owed by the bidder or any of its directors to the municipality, or to any other municipality or municipal entity, are in arrears for more than three (3) months; and*
- (k) *declare that I have not failed to perform satisfactorily during the last five (5) years on a previous contract with the Municipality, Municipal entity or any other organ of state, after written notice was given to me that my performance was unsatisfactory.*

Signed at.....this.....day of.....2019

**Authorised Signature:** \_\_\_\_\_

**Name of Bidding Entity:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**As witness:**            1. \_\_\_\_\_

**BIDDER:**  
**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**  
**Initial:** MCM .....



## **FORM 2.2.6    DECLARATION OF INTEREST**

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

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

3.1 Full Name: .....

3.2 Identity Number: .....

3.3 Company Registration Number: .....

3.4 Tax Reference Number: .....

3.5 VAT Registration Number: .....

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

3.6.1 If so, furnish particulars.

.....  
.....

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

If so, furnish particulars.

.....

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

3.8.1 If so, furnish particulars.

\_\_\_\_\_

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

- (a) a member of –
  - (i) any municipal Council;
  - (ii) any provincial legislature; or
  - (iii) the national Assembly or the national Council of provinces;
- (b) a member of the board of directors of any municipal entity;
- (c) an official of any municipality or municipal entity;
- (d) an employee of any national or provincial department, national or provincial public entity or constitutional institution with the meaning of the RSA, Public Finance Management Act, 1999 (Act No.1 of 1999);
- (e) a member of the accounting authority of any national or provincial public entity; or
- (f) an employee of Parliament or a provincial legislature.

### **BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

### **MCM:**

Initial: MCM .....

Witness: .....



.....  
.....  
3.9 Are you, aware of any relationship (family, friend, other) YES / NO  
between a bidder and any persons in the service of the state  
who may be involved with the evaluation and or adjudication of this bid?

3.9.1 If so, furnish particulars  
.....  
.....

3.10 Are any of the company's directors, managers, principle YES / NO  
shareholders or stakeholders in service of the state?

3.10.1 If so, furnish particulars.  
.....  
.....

3.11 Are any spouse, child or parent of the company's directors, YES / NO  
managers, principle shareholders or stakeholders in service  
of the state?

3.11.1 If so, furnish particulars.  
.....  
.....

### **CERTIFICATION**

I, THE UNDERSIGNED (NAME) .....CERTIFY THAT THE  
INFORMATION FURNISHED ON THIS DECLARATION FORM IS CORRECT.

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

SHOULD THE INFORMATION REQUIRED ON THIS FORM NOT DULY BE SUPPLIED, THIS BID WILL BE REJECTED.

.....  
Signature

.....  
Date

.....  
Position

.....  
Name of Bidding Entity

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



## **T2.3 RETURNABLE SCHEDULES THAT WILL BE INCORPORATED IN THE CONTRACT**

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FORM 2.3.4 GENERAL INFORMATION.....	56

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



## FORM 2.3.1 FORM CONCERNING FULFILMENT OF THE CONSTRUCTION REGULATIONS, 2003

In terms of regulation 4(3) of the RSA, Construction Regulations, 2003 (hereinafter referred to as the Regulations), promulgated on 18 July 2003 in terms of Section 43 of the RSA, Occupational Health and Safety Act, 1993 (Act No 85 of 1993) the Employer shall not appoint a contractor to perform construction work unless the Contractor can satisfy the Employer that his/her firm has the necessary competencies and resources to carry out the work safely and has allowed adequately in his/her bid for the due fulfilment of all the applicable requirements of the Act and the Regulations.

- 1 I confirm that I am fully conversant with the Regulations and that my company has (or will acquire/procure) the necessary competencies and resources to timeously, safely and successfully comply with all of the requirements of the Regulations. (Tick)

YES	
NO	

- 2 Proposed approach to achieve compliance with the Regulations (Tick)

Own resources, competent in terms of the Regulations (refer to 3 below)	
Own resources, still to be hired and/or trained (until competency is achieved)	
Specialist subcontract resources (competent) - specify: ..... ..... ..... ..... ..... .....	

- 3 Provide details of proposed key persons, competent in terms of the Regulations, who will form part of the Contract team as specified in the Regulations (CVs to be attached):

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

- 4 Provide details of proposed training (if any) that will be undergone:

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

- 5 Potential key risks identified and measures for addressing risks:

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



.....

.....

.....

.....

- 6 I have fully included in my bidden rates and prices (in the appropriate payment items provided in the Schedule of Quantities) for all resources, actions, training and any other costs required for the due fulfilment of the Regulations for the duration of the construction and defects repair period. (Tick)

YES	
NO	

SIGNATURE OF PERSON(S) AUTHORISED TO SIGN THIS BID:

1 ..... ID NO: .....

2 ..... ID NO: .....

**BIDDER:**  
**Initial:** Authorized signatory/ies: 1. ....  
 2. ....

**Witness:** .....

**MCM:**  
**Initial:** MCM .....



## **FORM 2.3.2 RECORD OF ADDENDA TO BID DOCUMENTS**

We confirm that the following communications received from the Procuring Department before the submission of this bid offer, amending the bid documents, have been taken into account in this bid offer:

	Date	Title or Details
1		Confirmatory notes of compulsory site/clarification meeting
2		
3		
4		
5		
6		
7		
8		
9		
10		

Attach additional pages if more space is required.

.....  
Signature of Authorized person:

.....  
Date:

Name: .....

Position: .....

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....





# MUNICIPAL COUNCIL OF MBABANE

## BID DOCUMENT

### FORM 2.3.4 GENERAL INFORMATION

1. Name of bidding entity:

\_\_\_\_\_

2. Contact details

Contact name and number: \_\_\_\_\_

Address of bidding entity:

\_\_\_\_\_

Postal code:

\_\_\_\_\_

Tel no: (        ) Fax no: (        )

\_\_\_\_\_

E-mail address:

\_\_\_\_\_

3. Legal entity: Mark with an X.

Sole proprietor	
Partnership	
Close corporation	
Company (Pty) Ltd	
Joint venture	

In the case of a Joint venture, provide details on joint venture members:

Joint venture member	Type of entity (as defined above)

4. Income tax reference number:

\_\_\_\_\_

(In the case of a joint venture, provide for all joint venture members)

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



5. VAT registration number:

\_\_\_\_\_  
(In the case of a joint venture, provide for all joint venture members)

6. Company or closed corporation registration number:

\_\_\_\_\_  
(In the case of a joint venture, provide for all joint venture members)

7. Details of proprietor, partners, closed corporation members, or company directors, indicating technical qualifications where applicable (Form on the next page).

8. For joint ventures the following must be attached:

- Written authority **of each JV partner**, for authorized signatory.
- The joint venture agreement.
- The major partner to satisfy at least 40 percent of the turnover and credit amount criteria, and each other partner at least 25 percent of the criteria.

**SIGNATURE OF AUTHORIZED PERSON** : .....

**DATE** : .....

**DETAILS OF PROPRIETOR, PARTNERS, CLOSED CORPORATION MEMBERS OR COMPANY DIRECTORS**

Name and Identity Number	Relevant qualifications and experience	Years of relevant experience

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



**MUNICIPAL COUNCIL OF MBABANE**

DEPARTMENT NAME: **TECHNICAL SERVICES**

**Contract No: 31-2018/2019**

FOR

**REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER**

**THE CONTRACT**

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**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**

**Initial:** MCM .....



**PART C1    AGREEMENT AND CONTRACT DATA**

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**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**

**Initial:** MCM .....



## **C1.1 FORM OF OFFER AND ACCEPTANCE**

### **FORM OF OFFER AND ACCEPTANCE (Agreement)**

#### **OFFER**

The Employer, identified in the Acceptance signature block, has solicited offers to enter into a contract in respect of the following works:

#### **REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER**

The Tenderer, identified in the Offer signature block below, has examined the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, and by submitting this Offer has accepted the Conditions of Tender.

By the representative of the Tenderer, deemed to be duly authorised, signing this part of this Form of Offer and Acceptance, the Tenderer offers to perform all of the obligations and liabilities of the Contractor under the Contract including compliance with all its terms and conditions according to their true intent and meaning for an amount to be determined in accordance with the Conditions of Contract identified in the Contract Data.

#### **THE OFFERED TOTAL OF THE PRICES INCLUSIVE OF VALUE ADDED TAX IS**

.....

.....Lilangeni (in words); SZL..... (in figures).

This Offer may be accepted by the Employer by signing the Acceptance part of this Form of Offer and Acceptance and returning one copy of this document to the Tenderer before the end of the period of validity stated in the Tender Data, whereupon the Tenderer becomes the party named as the Contractor in the Conditions of Contract identified in the Contract Data.

#### **FOR THE TENDERER:**

**Signature:** .....

**Name:** .....

**Capacity:** .....

**Name and address of organisation:**

.....

.....

.....

#### **BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

#### **MCM:**

**Initial:** MCM .....



## SIGNATURE AND NAME OF WITNESS:

Signature: .....

Name: .....

Date: .....

## ACCEPTANCE

By signing this part of this Form of Offer and Acceptance, the Employer identified below accepts the Tenderer's Offer. In consideration thereof, the Employer shall pay the Contractor the amount due in accordance with the Conditions of Contract identified in the Contract Data. Acceptance of the Tenderer's Offer shall form an agreement between the Employer and the Tenderer upon the terms and conditions contained in this Agreement and in the Contract that is the subject of this Agreement.

The terms of the contract, are contained in

- |        |   |
|--------|---|
| Part 1 | Agreements and Contract Data, (which includes this Agreement) |
| Part 2 | Pricing Data  |
| Part 3 | Scope of Work   |
| Part 4 | Site Information  |

and drawings and documents or parts thereof, which may be incorporated by reference into Parts 1 to 4 above.

Deviations from and amendments to the documents listed in the Tender Data and any addenda thereto listed in the Tender Schedules as well as any changes to the terms of the Offer agreed by the Tenderer and the Employer during this process of offer and acceptance, are contained in the Schedule of Deviations attached to and forming part of this Agreement. No amendments to or deviations from said documents are valid unless contained in this Schedule, which must be duly signed by the authorised representative(s) of both parties.

The Tenderer shall within two weeks after receiving a completed copy of this Agreement, including the Schedule of Deviations (if any), contact the Employer's agent (whose details are given in the Contract Data) to arrange the delivery of any bonds, guarantees, proof of insurance and any other documentation to be provided in terms of the Conditions of Contract identified in the Contract Data at, or just after, the date this Agreement comes into effect. Failure to fulfil any of these obligations in accordance with those terms shall constitute a repudiation of this Agreement.

Notwithstanding anything contained herein, this Agreement comes into effect on the date when the Tenderer receives one fully completed original copy of this document, including the Schedule of Deviations (if any). Unless the Tenderer (now Contractor) within five days of the date of such receipt notifies the Employer in writing of any reason why he cannot accept the contents of this Agreement, this Agreement shall constitute a binding contract between the parties.

## FOR THE EMPLOYER:

Signature: .....

### **BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

### **MCM:**

Initial: MCM .....



Name: .....

Capacity: .....

**NAME AND ADDRESS OF ORGANISATION:**

.....

.....

.....

**SIGNATURE AND NAME OF WITNESS:**

Signature: .....

Name: .....

Date: .....

**SCHEDULE OF DEVIATIONS**

Notes:

1. The extent of deviations from the tender documents issued by the Employer prior to the tender closing date is limited to those permitted in terms of the Conditions of Tender.
2. A Tenderer's covering letter shall not be included in the final contract document. Should any matter in such letter, which constitutes a deviation as aforesaid become the subject of agreements reached during the process of offer and acceptance, the outcome of such agreement shall be recorded here.
3. Any other matter arising from the process of offer and acceptance either as a confirmation, clarification or change to the tender documents and which it is agreed by the Parties becomes an obligation of the contract shall also be recorded here.
4. Any change or addition to the tender documents arising from the above agreements and recorded here, shall also be incorporated into the final draft of the Contract.

1 Subject .....

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



**Details**

.....

.....

.....

**2 Subject** .....

**Details**

.....

.....

.....

By the duly authorised representatives signing this Schedule of Deviations, the Employer and the Tenderer agree to and accept the foregoing Schedule of Deviations as the only deviations from and amendments to the documents listed in the Tender Data and addenda thereto as listed in the Tender Schedules, as well as any confirmation, clarification or change to the terms of the offer agreed by the Tenderer and the Employer during this process of offer and acceptance.

It is expressly agreed that no other matter whether in writing, oral communication or implied during the period between the issue of the tender documents and the receipt by the Tenderer of a completed signed copy of this Agreement shall have any meaning or effect in the contract between the parties arising from this Agreement.

**For the Tenderer:**

**For the Employer:**

..... **Signature** .....

..... **Name** .....

..... **Capacity** .....

**Name and address of organisation:**

**Name and address of organisation:**

.....

.....

.....

**BIDDER:**  
**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**  
**Initial:** MCM .....





..... **Witness signature** .....

..... **Witness name** .....

..... **Date** .....

### CONFIRMATION OF RECEIPT

The Tenderer, (now Contractor), identified in the Offer part of this Agreement hereby confirms receipt from the Employer, identified in the Acceptance part of this Agreement, of one fully completed original copy of this Agreement, including the Schedule of Deviations (if any) today:

the ..... (day)

of ..... (month) 20..... (year)

at ..... (place)

#### For the Contractor:

**Signature:** .....

**Name:** .....

**Capacity:** .....

#### Signature and name of witness:

**Signature:** .....

**Name:** .....

**BIDDER:**  
**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**  
**Initial:** MCM .....







Clause	
	The letter of appointment shall, unless the Contractor is notified to the contrary in writing, be taken as written instruction in accordance with Clause 5.6 of the GCC 2015 to commence with the work on the date of signing of the Tender. The Contractor must commence with the work within 14 (fourteen) days of the commencement date.
5.3.1	The documentation required before commencing with the Works are: <ol style="list-style-type: none"> <li>1. Health and Safety Plan (Refer to Clause 4.3)</li> <li>2. Initial programme (Refer to Clause 5.6)</li> <li>3. Security (Refer to Clause 6.2)</li> <li>4. Insurance (Refer to Clause 8.6)</li> </ol>
5.3.2	The time to submit the documentation required before commencement of the Works is 21 days.
5.5.1	The Time for Practical Completion specified for all sub-sections of this contract shall be specified by the Contractor in the Contract Data.
5.7	<i>Add the following to Sub-Clause 5.7.1:</i>  "No instruction of the Engineer to the Contractor to speed up the progress of the work, shall entitle the Contractor to additional remuneration, unless such instruction specifically mentions that the Contractor is entitled to additional remuneration, as well as the amount of remuneration, or in which way such remuneration will be calculated".
5.13	The amount due to the Client by the Contractor for damages incurred because of delays as defined in Clause 5.13 of the GCC 2015, amounts to the <b>contract value x SZL 0.0575 per SZL 100.00 per calendar day</b> . The Employer reserves the right to recover actual losses where applicable.  <i>Add Sub-Clause 5.13.3 to Clause 5.13:</i>  "Notwithstanding abovementioned, should the construction fall behind with regard to the construction program as submitted in terms of <i>Clause 5.6</i> , or any changes in terms of <i>Clause 5.5</i> , then, after written instruction has been given in this matter, the Engineer will give the Contractor 7 (seven) days grace to catch up. Should the Contractor fail to catch up with the construction program, <b>the Client will have the right to appoint any other Contractor to help the Contractor to catch up on lost time, or to complete the outstanding work on behalf of the Contractor under this Contract.</b>  <b><i>In the event where such an additional Contractor gets appointed to complete the outstanding work, the Contractor shall be obliged to remunerate the additional Contractor for such work in terms of this Contract. Any difference in costs as asked by the additional Contractor and the cost of the concerned work as Tendered by the Contractor and as adjusted by the Price Adjustment Formula, where applicable, shall be carried by the Contractor.</i></b>
5.16.3	The latent defects period is not applicable as this is essentially a repair project to be covered upon completion.
6.3.1.5	Only additional work, for which the Contractor received written notification from the Engineer, shall be remunerated. The Contractor must apply in writing to request remuneration for additional work. Also see <b>Error! Reference source not found.</b> ,
6.7.5	The Engineer shall do measurement for the monthly payment certificates. Where ways of calculating for quantities for the Bill of Quantities differ from ways of calculating as set out under Standard Specifications, the way it has been set out in the Bill of Quantities, shall be used. Measuring shall be done in accordance with the <b>drawings</b> or the <b>altered drawings</b> .

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



Clause	
6.9	<p>Material on site, for which the Contractor has received payment, becomes the <b>property</b> of the Client and may not be removed from the site without written consent from the Engineer. Decisions about whether material on site shall be paid, depends solely on the Engineer. Material on site shall also only be paid for if it is stored in a safe and secure place and at the discretion of the Engineer. Payment for material on site shall only be done if the Contractor supplies <b>invoices</b> to the Engineer.</p> <p>The Engineer reserves the right to withhold payment for material on site, until the Contractor can supply, on request of the Engineer, <b>written</b> proof of <b>ownership</b> from the Supplier of material on site.</p>
6.10.3	The limit of retention money is 10% of the value of the work done but limited to 10% of the Completion Payment Certificate value.
10.4	Dispute resolution shall be by Arbitration
10.5.3	Number of members shall be one

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



## PART 2: DATA PROVIDED BY THE CONTRACTOR

<b>Clause</b>	
1(1)(h) 1(2)	<p>The Contractor is .....</p> <p>The Contractor's address for receipt of communications is:</p> <p>Physical address: Postal address:</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>.....</p> <p>Telephone: .....</p> <p>Fax: .....</p> <p>E-mail: .....</p>
1(1)(m)	<p>The time for completing the works is .....days</p>
37(2)(b)	<p>The percentage allowances to cover all charges for the Contractor's and subcontractor's profits, timekeeping, clerical work, insurance, establishment, superintendence and the use of hand tools</p> <p>is .....%</p>
46(3)	<p>The rate for special materials, exclusive of value-added tax (VAT) are:</p> <p>.....</p>

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**  
**Initial:** MCM .....



## **C1.2.2 SPECIAL CONDITIONS OF CONTRACT**

The following definite conditions will be applicable to this specific contract. The description hereafter of items as specified in the GCC 2015, serves as extensions to the different items and must not be seen as a replacement of the GCC 2015.

Where any contradictions appear between the Standard Specifications of all trades, as described elsewhere in the document, the GCC 2015 and the Tender Data, the Tender Data will be accepted as the correct specification and shall be applicable to these works.

<b>Clause</b>	
1.1.1.13	The duration of the Defects Liability Period of the Works, as set out in <b>Clause 1.1.1.13</b> of the GCC 2015, are 12 (twelve) months from the <b>date of completion</b> of the Works as certified by the Engineer.
1.1.1.15	Clause 1.1.1.15 of the GCC 2015 denotes Municipal Council of Mbabane. For the purpose of this Tender "Client" shall have the same meaning as "Employer" and vice-versa.
1.1.1.16	<p>"Engineer" means "Any Partner, Associate or Professional Engineer" whom is generally or specifically assigned by a Partner of Pasco to fulfil the function as Engineer on behalf of Pasco, Consulting Engineers, in terms of the GCC 2015 for the execution of this Contract.</p> <p>The Engineer shall also act as the Client's Agent with contact details as stipulated under Volume 1, T1.2 Tender Data.</p>
1.1.1.17	<p>Should the Engineer have a Representative on site, he shall notify the Contractor in writing accordingly. For the purpose of this contract, the Representative shall, as appointed by the Engineer in writing, have the same authority as the Engineer. However, the Engineer's decision will be binding should any dispute take place.</p> <p>No decision by the Representative or any work approved by the Representative shall exempt the Contractor from his responsibilities. The Engineer reserves the right to revoke any work approved by the Representative, without additional remuneration to the Contractor.</p>
2.4	<p>Should there be any contradictions, obscurities or doubt in the text of the Tender Document or drawings, or if any obvious errors or illegible figures are found, the Contractor must, <b>before submitting the Tender</b>, get a written, signed declaration of the correct meaning of such descriptions, figures, clauses, etc. from the Engineer.</p> <p>The Contractor shall not be permitted to submit any claims against the Client and/or Engineer after closing of Tender due to the abovementioned reasons.</p> <p>The Contractor must examine the Tender Documents to ensure that it contains all the applicable pages and that a complete set of drawings has been issued. The Contractor must notify the Engineer accordingly should any pages and/or drawings not be there. The Engineer shall then immediately supply a complete set of Tender Documents and/or drawings in exchange of the incomplete set of Tender Documents and/or drawings.</p> <p>Only information that was <b>formally</b> issued in <b>writing</b> by the Engineer to Tenderers during the Tender period will form part of the Tender. No information that was given orally to Tenderers during the site inspection and/or during the Tender period will be binding to the Tender and will not be deemed to be part of the Tender document. During the site inspection, certain additional information will, if deemed necessary, be included in the minutes of the site inspection, which will be issued to all Tenderers.</p> <p>All information contained in the minutes of the site inspection and/or that was formally issued in writing by the Engineer to Tenderers during the Tender period will be binding to the Tender and deemed to be part of the Tender document.</p>
4.4	<p>Add to Clause 4.4.4:</p> <p>Where so instructed by the Engineer, an independent Contractor or Contractors shall execute work.</p>

**BIDDER:**

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Clause	
	<p>The Contractor for the prescribed work shall serve as Sub-Contractor. The Contractor for the contract shall do everything in his power and to the satisfaction of the Engineer to ensure that the incorporation of the Sub-Contractor with the contract will run smoothly.</p> <p>The Contractor has the opportunity to allow for remuneration for his supervision and help to the Sub-Contractor in the Bill of Quantities and this will be taken as complete remuneration of the Contractor to comply with these instructions. The Contractor shall pay the Sub-Contractor, unless differently instructed by the Engineer. Payment to the Sub-Contractor shall be made within 7 (seven) days after the Contractor has received his payment. Should this not take place, interest will be paid at prime rate plus 2 (two) percent. Interest will be deducted from payment to the Contractor. The Sub-Contractor must supply written proof that all previous payments have been made to him before a subsequent payment will be made to the Contractor.</p> <p>After expiry of the retention period, the Contractor must, when requested by the Engineer in writing, hand over a bank guaranteed cheque in favour of the Sub-Contractor to the value of the retention monies due to the Sub-Contractor, to the Engineer. The Engineer will not hand the cheque over to the Sub-Contractor until such time as the Client has paid the outstanding retention monies to the Contractor.</p> <p>The Contractor shall be held responsible for any losses suffered by the Client due to delays of the Sub-Contractor or any other losses suffered by the Client due to actions, conduct, etc. by the Contractor or any of his staff.</p>
4.5.4	It shall be accepted that the Contractor provide for payment of Clause 4.5.4 under Section A of the Bill of Quantities. No further payments will be made to the Contractor under this Clause.
4.8	<p>Add Sub-Clause 4.8.3 to Clause 4.8:</p> <p>"The Contractor's attention is drawn to the fact that other Works by independent Contractors may be done simultaneously with this project.</p> <p>The other Work that may be done simultaneously with this contract by independent Contractors is not limited. The Contractor must ensure that neither his own nor his employees' operations interfere or place hindrances in the way of operations to be performed by the Employer or other Contractors. The Contractor herewith safeguards the Employer should any claims arise in this matter.</p> <p>Any claims arising due to damages to existing services or works or any obstructions or hindrances caused by the Contractor and other parties, shall be the responsibility of the Contractor.</p> <p>Any repair work, improvements or replacing of unsatisfactory work, shall be at the expense of the Contractor and to the Engineer's satisfaction".</p>
4.10.2	<p>Replace the contents of Clause 4.10.2 with the following:</p> <p>"The Contractor must supply a detailed list of supervising staff and employees taken into service for the execution of this contract, according to their respective categories, to the Engineer on a monthly basis. Such a report must be supplied during the <b>monthly site meeting</b>".</p>
5.9	<p>One set of drawings shall be issued together with the Tender documents. The drawings may also be inspected at the office of the Engineer during normal office hours.</p> <p>The Contractor shall receive 3 (three) complete sets of drawings and 2 (two) blank documents at the handing over of the site. 1 (One) complete set of drawings and 1 (one) blank document of abovementioned drawings and documents must always be available on site for the exclusive use of the Engineer. Any additional drawings and documents will be supplied to the Contractor at his own expense.</p> <p>Add Sub-Clause 5.9.8 to Clause 5.9:</p> <p>"Only dimensions shown on the drawings may be used for the construction of the Works. <b>No dimensions</b> may be scaled down from the drawings without written consent from the Engineer".</p>
5.12.2.2	Should there be any <b>abnormal rain and/or wet conditions</b> during the period of completion of the Works or any extension of time, as granted under <i>Clause 5.10</i> of the <i>GCC 2015</i> , an extension of time will be granted in

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Clause	
	<p>accordance with Clause 5.10 of the GCC 2015 by the Client in accordance with the following formula for each calendar month or part thereof:</p> $V = (N - N_n) + \frac{(R - R_n)}{X}$ <p>V = Delay due to rain in calendar days for the calendar month under consideration.  Nw = Actual number of days during the calendar month on which a rainfall of Y mm or more per day has been recorded.  Nn = Average number of days, as derived from existing official records, on which a rainfall of Y mm or more has been recorded for the calendar month.  Rw = Actual rainfall measured in mm for the calendar month under consideration.  Rn = Average rainfall in mm as derived from official records for the calendar month.  Nn, Rn, X and Y's values shall be as given hereunder.</p> <p>Refer to project specification s PS 15 for the actual and average rainfall values for the project area.</p> <p>The total extension of time granted due to abnormal rainfall and/or wet conditions, according to Clause 5.12.2.2 of the GCC 2015, shall be the algebraically sum of all monthly totals for the time under consideration. <b>Should the figure be negative due to less than average rainfall, the time for completion will not be reduced.</b> Extension of time for part of a month will be determined with a pro-rata value for Nn and Rn.</p> <p>The abovementioned comparison does not provide for flood damages that might have further or concurrent delays. Possible claims due to flood damages will be handled separately with regard to extension of time. The factor (Nw-Nn) shall be considered to represent a fair allowance for variations from the average number of days during which rainfall exceeds Y mm. The factor (Rw-Rn)/X shall be considered to represent a fair allowance for variations from the average in the number of days during which the rainfall did not exceed Y mm, but wet conditions prevented or disrupted work.</p> <p>Accurate rain gauging's shall be taken at a suitable point on the site daily at <b>08:00</b> unless otherwise agreed to by the Engineer and the Contractor shall, at his own expense, take all necessary precautions to ensure that the rain gauges cannot be interfered with by unauthorized persons.</p> <p>Information regarding existing rainfall records, if available from a suitable rainfall station near the site, will be supplied in the project specifications together with calculations of rain delays for previous years in accordance with the above formula. The average of these delays will be regarded as normal rain delays which the contractor shall accommodate in his programme, and for which no extension of time will be considered.  If no suitable rainfall records are available, the above formula will not apply.</p>
5.14	<p>The Engineer is entitled to approve work as it is completed. Work that has been approved shall not be taken as acceptable for <i>taking-over</i> with regard to <b>retention purposes</b>, unless a certificate has been issued in this regard. Taking-over with retention in mind, shall only take place with the completion and approval of the Works.</p>
5.14.1	<p>The requirements for achieving Practical Completion is:</p> <ol style="list-style-type: none"> <li>A completed project due to the nature and size of the works.</li> </ol>
6.2	<p>It shall be expected of the Contractor to make use of the Surety Forms included in this Tender. No sureties shall be accepted from companies in which the Contractor or his fellow partners or directors are involved.  Add the following <i>Sub-Clause 6.2.4</i> to the existing <i>Clause 6.2. of the GCC 2015</i>:</p> <p>6.2.4 Should any such guarantee, Company or Bank -</p> <ol style="list-style-type: none"> <li>be sequestered, go into liquidation or be placed in execution (preliminary or finally), or</li> <li>does not respond to a lawful finding within 7 (seven) days, or</li> <li>enter or try to enter into a general agreement with his/their creditors, or</li> <li>in general, does not promptly comply with his/their liabilities, or</li> <li>give the Employer reason to being doubtful about his/their ability or preparedness to meet his/their responsibilities as in Sub-Clause (1) of this Clause [the Employer shall be entitled to ask the Contractor to supply a new surety or sureties, or a new guarantee from an Insurance- or any Registered Company or Bank within 7 (seven) days and the definition of Sub-Clause (1) of this</li> </ol>

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Clause	
	Clause will be applicable mutates mutandis with regard to such surety, sureties or guarantee. Payment shall be in <i>Section A: General in the Bill of Quantities</i> ].
6.3 and 6.4	Any work that the Contractor must or would like to do for which he would expect to receive compensation and for which no allowance has been made in this Bill of Quantities, must only be executed if written, Client approved variation orders have been issued to the Contractor.  Work done for which no variation order has been issued and that has not been allowed for in the Bill of Quantities shall be done at the Contractor's own expense. Should the Contractor ask for changes or additional work without supplying the cost implications with his request, it will be accepted that there are no cost implications.
6.3.1.5	Only additional work, for which the Contractor received <b>written notification</b> from the Engineer, shall be remunerated. The Contractor must <b>apply</b> in writing to <b>request</b> remuneration for additional work. Also see <b>Error! Reference source not found. Error! Reference source not found.</b>
6.7.5	The Engineer shall do measurement for the monthly payment certificates. Where ways of calculating for quantities for the Bill of Quantities differ from ways of calculating as set out under Standard Specifications, the way it has been set out in the Bill of Quantities, shall be used. Measuring shall be done in accordance with the <b>drawings</b> or the <b>altered drawings</b> .
6.10.1	Payment shall be done in accordance with <b>Clause 6.10.1</b> of the <i>GCC 2015</i> .
7.1	Add Clause 7.1.2 to Clause 7.1: "The Contractor must supply a detailed inventory of construction equipment on site to the Engineer on a monthly basis. Distinction must be made between working and non-working equipment on a daily basis. Such a report must be supplied during the monthly site meeting".
7.4.3	Water pipes will be tested to <b>SANS 1200</b> and evaluation of density tests shall be done in accordance with <b>TRH5</b> . There will however be no conditional acceptance of test results. Only tests requested in writing by the Engineer and that has been accepted by the Engineer, shall be considered for payment.
7.5.3	The Contractor must give the Engineer at least 48 (forty-eight) hours' notice should an inspection be needed.
8.1	The Contractor must ensure at all times, <b>especially at night</b> , that all excavations are properly safeguarded with the necessary road signs, chevron safety bands, lights, etc. The Engineer reserves the right to instruct the Contractor to supply <b>additional safety measures, without additional payment</b> . Remuneration to comply with these requirements must be included in the Tendered amounts in <b>Section A of the Bill of Quantities</b> and no additional payment will be made. The possible cost of shoring of excavation sides must be included in the cost of excavations. The Engineer reserves the right to request shoring or to strengthen any shoring without additional remuneration to the Contractor.
8.6	i. <b>GENERAL</b> Remuneration of Tendered amounts for insurance under Section A of the Bill of Quantities will not be certified, unless the Contractor can prove that instalments have been paid. Engineer can at any time request proof of payment. Receipts will not be accepted as sufficient evidence. Written proof from the Insurer shall be required. ii. <b>INSURANCE AGAINST "POLITICAL RIOTING" ADD (CLAUSE 8.6.1.2)</b> Insurance against "Political Rioting" must be taken out on the contract. "Political Rioting" risks must be considered only as the risks for which the South African Special Risk Insurance Association provides for, according to their Regulations that are valid for the duration of the Tender. The Client must submit any delays of the contract as a direct result of riots to the Engineer for consideration. The Engineer and the Client shall consider every case on merit. The Contractor must indemnify the Client against all damages as a result of riots under Section A in the Bill of Quantities. The Client shall not compensate the Contractor for any damages due to rioting.

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

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Clause	
	With the stipulation of the insured amount in accordance with <i>Clause 8.6.1.1</i> of the <i>GCC 2015</i> , an amount equal to at least 10 (ten) % of the contract value must be supplied for Professional fees for <i>Clause 8.6.1.1.2</i> of the <i>GCC 2015</i> .
9.2	Further to <b>Clause 9.2</b> of the <i>GCC 2015</i> , the Contractor shall supply the Engineer with a complete list of equipment, as well as a declaration of ownership of such equipment, i.e. also rented equipment. It is necessary that the ownership of the equipment be declared, especially with reference to confiscation when the Works are set foot on by the Employer in terms of <b>Clause 9.2</b> of the <i>GCC 2015</i> .

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

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Witness: .....

**MCM:**

Initial: MCM .....



### **C1.3 FORM OF GUARANTEE**

#### **PRO FORMA**

#### **Contract No: 31-2018/2019**

WHEREAS MUNICIPAL COUNCIL OF MBABANE (hereinafter referred to as "the Employer") entered into, a Contract with \_\_\_\_\_  
(hereinafter called "the Contractor") on the \_\_\_\_\_ day of \_\_\_\_\_ 20\_\_\_\_ for

#### **Replacement of Mbabane Sanitary Landfill Leachate Pond Liner and Repairs to the Landfill Base Liner at Mpolonjeni**

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

AND WHEREAS \_\_\_\_\_  
has/have at the request of the Contractor, agreed to give such guarantee;

NOW THEREFORE WE, \_\_\_\_\_ do hereby guarantee and bind ourselves jointly and severally as Guarantor and Co-principal Debtors to the Employer under renunciation of the benefits of division and excursion for the due and faithful performance by the Contractor of all the terms and conditions of the said Contract, subject to the following conditions:

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

\_\_\_\_\_ (R \_\_\_\_\_)

#### **BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

#### **MCM:**

Initial: MCM .....



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

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

\_\_\_\_\_

IN WITNESS WHEREOF this guarantee has been executed by us at \_\_\_\_\_

on this \_\_\_\_\_ day of \_\_\_\_\_ 20 \_\_\_\_\_

As witnesses:

1. \_\_\_\_\_ Signature \_\_\_\_\_

2. \_\_\_\_\_ Signature \_\_\_\_\_

Duly authorized to sign on behalf of \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

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Witness: .....

**MCM:**

Initial: MCM .....



**FORM C1.4      AGREEMENT IN TERMS OF THE OCUPATIONAL HEALTH AND SAFETY RSA**  
**ACT, 1993 (ACT NO 85 OF 1993)**

THIS AGREEMENT made at \_\_\_\_\_

on this the \_\_\_\_\_ day of \_\_\_\_\_ in the year \_\_\_\_\_

between **THE MUNICIPAL COUNCIL OF MBABANE** (hereinafter called "the **Employer**") of the one part, herein represented by

in his capacity as \_\_\_\_\_

and

\_\_\_\_\_  
(hereinafter called "the Mandatory") of the other part, herein represented by

\_\_\_\_\_  
in his capacity as \_\_\_\_\_

WHEREAS the Employer is desirous that certain works be constructed, viz

\_\_\_\_\_  
and has accepted a Bid by the Mandatory for the construction, completion and maintenance of such Works and whereas the Employer and the Mandatory have agreed to certain arrangements and procedures to be followed in order to ensure compliance by the Mandatory with the provisions of the Occupational Health and Safety Act, 1993 (Act 85 of 1993);

NOW THEREFORE THIS AGREEMENT WITNESSETH AS FOLLOWS:

- 1      The Mandatory shall execute the work in accordance with the Contract Documents pertaining to this Contract.
- 2      This Agreement shall hold good from its Commencement Date, which shall be the date of a written notice from the Employer or Engineer requiring him to commence the execution of the Works, to either
  - (a)    the date of the Final Approval Certificate issued in terms of Clause 6.10.8 of the General Conditions of Contract (hereinafter referred to as "the GCC"),
  - (b)    the date of termination of the Contract in terms of Clauses 9.1 of the GCC.
- 3      The Mandatory declares himself to be conversant with the following:
  - (a)    All the requirements, regulations and standards of the Occupational Health and Safety Act (Act 85 of 1993), hereinafter referred to as "The Act", together with its amendments and with special reference to the following Sections of The Act:
    - (i)    Section 8      :      General duties of employers to their employees;
    - (ii)   Section 9      :      General duties of employers and self-employed persons to persons other than employees;

**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

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**MCM:**

**Initial:** MCM .....



- (iii) Section 37 : Acts or omissions by employees or mandatories, and
- (iv) Subsection 37(2) relating to the purpose and meaning of this Agreement.
- (b) The procedures and safety rules of the Employer as pertaining to the Mandatory and to all his subcontractors.
- 4 In addition to the requirements of Clause 4.3 of the GCC and all relevant requirements of the above-mentioned Volume 3, the Mandatory agrees to execute all the Works forming part of this Contract and to operate and utilise all machinery, plant and equipment in accordance with the Act.
- 5 The Mandatory is responsible for the compliance with the Act by all his subcontractors, whether or not selected and/or approved by the Employer.
- 6 ***The Mandatory warrants that all his and his subcontractors' workmen are covered in terms of the Compensation for Occupational Injuries and Diseases Act, 1993 which cover shall remain in force whilst any such workmen are present on site. A letter of good standing from the Compensation Commissioner to this effect must be produced to the Employer upon signature of the agreement.***
- 7 The Mandatory undertakes to ensure that he and/or subcontractors and/or their respective employers will at all times comply with the following conditions:
  - (a) The Mandatory shall assume the responsibility in terms of Section 16.1 of the Occupational Health and Safety Act. The Mandatory shall not delegate any duty in terms of Section 16.2 of this Act without the prior written approval of the Employer. If the Mandatory obtains such approval and delegates any duty in terms of section 16.2 a copy of such written delegation shall immediately be forwarded to the Employer.
  - (b) All incidents referred to in the Occupational Health and Safety Act shall be reported by the Mandatory to the Department of Labour as well as to the Employer. The Employer will further be provided with copies of all written documentation relating to any incident.
  - (c) The Employer hereby obtains an interest in the issue of any formal inquiry conducted in terms of section 32 of the Occupational Health and Safety Act into any incident involving the Mandatory and/or his employees and/or his subcontractors.
- 8. **The contact details of the OH&S Agent for the MCM is as follows:**  
 Mr. Mduduzi Dlamini  
 Tel: (+268) 24097000  
 Fax: (+268) 24042611

In witness thereof the parties hereto have set their signatures hereon in the presence of the subscribing witnesses:

**BIDDER:**  
 Initial: Authorized signatory/ies: 1. ....  
 2. ....

Witness: .....

**MCM:**  
 Initial: MCM .....



**SIGNED FOR AND ON BEHALF OF THE EMPLOYER:**

WITNESS .....

**NAME** .....  
(IN CAPITALS)

**SIGNED FOR AND ON BEHALF OF THE MANDATORY:**

WITNESS ..... .

**NAME** .....  
(IN CAPITALS)

**BIDDER:**  
**Initial:** Authorized signatory/ies: 1. ....  
2. ....

**Witness:** .....

**MCM:**  
**Initial:** MCM .....





**MUNICIPAL COUNCIL OF MBABANE**

DEPARTMENT NAME: **TECHNICAL SERVICES**

**Contract No: 31-2018/2019**

FOR

**REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER**

**PART C2 PRICING DATA**

PAGE(S)

C2.1 PRICING INSTRUCTIONS

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C2.2 BILL OF QUANTITY

85

**BIDDER:**

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## **C2.1 PRICING INSTRUCTIONS**

- 1 The General Conditions of Contract, the Contract Data, the Specifications (including the Project Specifications and Particular Specifications) and the Drawings shall be read in conjunction with the Bill of Quantities.
- 2 The Bill comprises items covering the Contractor's profit and costs of general liabilities and of the construction of Temporary and Permanent Works.

Although the Bidder is at liberty to insert a rate of his own choosing for each item in the Bill, he should note the fact that the Contractor is entitled, under various circumstances, to payment for additional work carried out and that the Engineer is obliged to base his assessment of the rates to be paid for such additional work on the rates the Contractor inserted in the Bill.

Clause 8 of each Standardized Specification, and the measurement and payment clause of each Particular Specification, read together with the relevant clauses of the Project Specifications and Particular Specification, all set out which ancillary or associated activities are included in the rates for the specified operations.

- 3 Descriptions in the Bill of Quantities are abbreviated and may differ from those in the Standardized, Project Specifications and Particular Specifications. No consideration will be given to any claim by the Contractor submitted on such a basis. The Bill has been drawn up generally in accordance with the latest issue of Civil Engineering Quantities<sup>3</sup>. Should any requirement of the measurement and payment clause of the appropriate Standardized or Project Specification(s) be contrary to the terms of the Bill or, when relevant, to the Civil Engineering Quantities, the requirement of the appropriate Standardized, Project, or Particular Specification as the case may be, shall prevail.
- 4 Unless stated to the contrary, items are measured net in accordance with the Drawings and as built surveys without any allowance having been made for waste.
- 5 The amounts and rates to be inserted in the Bill of Quantities shall be the full inclusive amounts to the Employer for the work described under the several items. Such amounts shall cover all the costs and expenses that may be required in and for the construction of the work described, and shall cover the costs of all general risks, profits, taxes (but excluding value-added tax), liabilities and obligations set forth or implied in the documents on which the Bid is based.
- 6 The quantities of work and materials set forth in the Schedule of Quantities are estimates only, and shall not be considered as limiting or extending the amount of work to be done and materials to be supplied by the Contractor, nor shall these quantities be regarded as constituting authority to the Contractor to order materials for or executing work or making arrangements therefore. The quantities of work finally accepted and certified for payment, and not the quantities given in the Schedule of Quantities, shall be used for determining payments to the Contractor

The validity of the Contract shall in no way be affected by differences between the quantities in the Schedule of Quantities and the quantities finally certified for payment. Work shall be valued at the rates or lump sum prices tendered, subject only to the provisions of the General Conditions of Contract.

- 7 An amount or rate shall be entered against each item in the Bill of Quantities, whether or not quantities are stated. An item against which no amount or rate is entered will be considered to be covered by the other amounts or rates in the Bill.

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<sup>3</sup> The standard system of measurement of civil engineering quantities published by the South African Institution of Civil Engineers.

**BIDDER:**

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The Bidder shall also fill in a rate against the items where the words "rate only" appear in the amount column. Although no work is foreseen under these items and no quantities are consequently given in the quantity column, the bid rates shall apply should work under these items actually be required.

Should the Bidder group a number of items together and bid one sum for such group of items, the single bid sum shall apply to that group of items and not to each individual item, or should he indicate against any item that full compensation for such item has been included in another item, the rate for the item included in another item shall be deemed to be nil.

The bid rates, prices and sums shall, subject only to the provisions of the Conditions of Contract, remain valid irrespective of any change in the quantities during the execution of the Contract.

- 8 The quantities of work as measured and accepted and certified for payment in accordance with the Conditions of Contract, and not the quantities stated in the Bill of Quantities, will be used to determine payments to the Contractor. The validity of the Contract shall in no way be affected by differences between the quantities in the Bill of Quantities and the quantities certified for payment.

**Ordering of materials** are not to be based on the Bill of Quantities, but only on information issued for construction purposes.

- 9 The Engineer will, with the Contractor's concurrence, make or cause the Contractor to make such adjustments to rates, extensions and costs as he considers necessary to rectify discrepancies, subject to the following:

- a. In general where an error occurs in the extension it shall be deemed that the rate is correct and the Tender Price will be adjusted accordingly.
- b. Any error of addition shall be corrected and the Tender Price amended accordingly.
- c. Correction of errors shall not be the cause for withdrawal of a Tender.

- 10 For the purposes of this Bill of Quantities, the following words shall have the meanings hereby assigned to them:

Unit	:	The unit of measurement for each item of work as defined in the Standardized, Project or Particular Specifications
Quantity	:	The number of units of work for each item
Rate	:	The payment per unit of work at which the Bidder bids to do the work
Amount	:	The quantity of an item multiplied by the bid rate of the (same) item
Sum	:	An amount bid 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

- 11 The units of measurement indicated in the Bill of Quantities are metric units. The following abbreviations may appear in the Bill of Quantities:

mm	=	millimetre
m	=	metre
km	=	kilometre
km-pass	=	kilometre-pass
m <sup>2</sup>	=	square metre

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m <sup>2</sup> -pass	=	square metre-pass
ha	=	hectare
m <sup>3</sup>	=	cubic metre
m <sup>3</sup> -km	=	cubic metre-kilometre
kW	=	kilowatt
kN	=	kilonewton
kg	=	kilogram
t	=	ton (1 000 kg)
%	=	per cent
MN	=	meganeutron
MN-m	=	meganeutron-metre
PC Sum	=	Prime Cost Sum
Prov Sum	=	Provisional Sum

## WAGE RATES

CATEGORIES OF LABOUR	RATE/HOUR	RATE/DAY	RATE/STANDING TIME

The Contractor's normal working week comprises\_\_\_\_\_ hours.

The Contractor's normal working day comprises\_\_\_\_\_ hours.

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**  
Initial: MCM .....



## MATERIALS

Percentage addition on net cost of materials not already included in the Contract to cover Contractor's profit, waste etc.

\_\_\_\_\_ %

## PLANT AVAILABLE ON SITE

DESCRIPTION	RATE/HOUR	RATE/DAY	RATE/STANDING TIME

### **NB: PLEASE STATE THE FOLLOWING:**

- ARE/IS BID PRICE/S FIRM:

YES	NO
-----	----

- IF THE BID PRICE(S) ARE NOT FIRM, SUPPLY THE INFORMATION REGARDING ESCALATION APPLICABLE TO THIS BID:

.....

.....

### **BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

### **MCM:**

Initial: MCM .....



**MUNICIPAL COUNCIL OF MBABANE**DEPARTMENT NAME: **TECHNICAL SERVICES****Contract No: 31-2018/2019**

FOR

**REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER****C2.2 BILL OF QUANTITIES****NB**

TENDERERS MUST COMPLETE THE SCHEDULE OF QUANTITIES IN BLACK INK

ITEM NO.	PAYMENT REFERS TO	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
<b>1.0</b>	<b>SANS 1200AA</b>					
<b>1.1</b>	<b>8.3</b>	<b>SCHEDULED FIXED CHARGE AND VALUE RELATED ITEMS</b>				
1.1.1	8.3.1	Contractual requirements: Insurance (public liability, works insurance), Sureties, UIF, WCA, etc.	Sum	1		
1.1.2	8.3.2.2	Establish on site all facilities required by the Contractor and bring to site all equipment necessary for operations	Sum	1		
1.1.3	8.3.3	General responsibilities and other fixed charge obligations	Sum	1		
1.1.4	8.3.4	Remove contractors site establishment on completion	Sum	1		
<b>1.2</b>	<b>8.4</b>	<b>SCHEDULED TIME RELATED ITEMS</b>				
1.2.1	8.4.1	Contractual requirements for duration of construction, insurance etc.	Month	1		
1.2.2	8.4.2	Maintain facilities for duration of contract Offices, ablutions, diesel tank, toilets, vehicle yard, etc.	Month	1		
1.2.3	8.4.3	General responsibilities and other time-related obligations	Month	1		
		<b>TOTAL FOR PAGE CARRIED FORWARD TO NEXT PAGE</b>				

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



SECTION  
1200 A

ITEM NO	PAYMENT REFERS TO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
		TOTAL BROAGHT FORWARD FROM PREVIOUS PAGE				
1.4		<b>OCCUPATIONAL HEALTH AND SAFETY REQUIREMENTS</b>				
1.4.1	PS HS	Provision for adhering to all requirements of the contract	Sum			
1.5		<b>ENVIRONMENTAL REQUIREMENTS</b>				
1.5.1	PS ENV	Provision for adhering to all requirements of the contract	Sum			
1.6		<b>Day works</b>				
1.6.1		Personnel - Normal Time				
		(i) - Supervisor	hr	20		
		(ii) - Operator	hr	40		
		(iii) - Artisan	hr	40		
		(iv) - Labourer	hr	50		
		a) - Skilled	hr	20		
		b) - Semi Skilled	hr	40		
1.6.3		Plant				
		(i) - LDV	hr	40		
		(ii) - Tipper truck - 5m <sup>3</sup> min	hr	40		
1.7		Repairs to leachate pump suction pipe, non-return valve, protection year and auxiliary works to be executed <b>as per the</b> Engineer's site instructions			Prov. Sum	50 000.00
1.7.1		<b>Allowance for overheads, charges and profit on item 1.7 above</b>	%	R 50 000.00	.....%	
		TOTAL: PRELIMINARY & GENERAL CARRIED TO SUMMARY				

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



SECTION  
1200 C

ITEM NO	PAYMENT REFERS TO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
130	SABS 1200 C	<b><u>SITE CLEARANCE</u></b>				
130.01	PSC 8.2.1	<b>Clear and grub:</b>				
		0.01 Areas	m <sup>2</sup>	2 500		
		0.02 Strips, 10 m wide	m	100		
130.04	8.2.4	<b>Re-clear surfaces (only on instructions from engineer):</b>				
		0.01 Areas	m <sup>2</sup>	200		
		0.02 Strips, 5 m wide	m	20		
130.11	8.2.10	Remove drainage stone to nominal depth of 300 mm and stockpile	m <sup>3</sup>	600		
130.12		<b>Clear water body (leachate) and silt / sediment inside the pond and safely dispose at the existing landfill cell.</b>	m <sup>3</sup>	500		
		<b>TOTAL: SITE CLEARANCE CARRIED TO SUMMARY</b>				

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....





**SECTION  
PS GT & GM**

ITEM NO	PAYMENT REFERS TO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
<b>140</b>		<b>CELL LINER INSTALLATION / REPAIR</b>				
140.1	PS GM 6	Supply and install 1,5 mm thick HDPE geomembrane liner ( <b>texture both sides</b> ) to landfill, including anchorage, all jointing, trimming, and wastage	m <sup>2</sup>	2 500		
140.2	PS GT 3.1	Supply and install non- woven needle punched protection geotextile (400 g/m <sup>2</sup> ), including all jointing, trimming, and wastage	m <sup>2</sup>	2 500		
		<b>TOTAL: CELL LINER REPAIR AND INSTALLATION CARRIED TO SUMMARY</b>				

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



SECTION  
PS GT & GM

ITEM NO	PAYMENT REFERS TO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
150		<b>LEACHATE POND LINER REPAIR AND REPLACEMENT</b>				
150.1	PS GM 7.5	Repair the existing primary liner at the base and some obvious breaches on the side slopes	No	110		
150.2	PS GCDC 5.1	Supply and install 6mm Cuspated geocomposite drainage system on top of the existing primary liner to form a new leachate leakage detection system and <b>connect 2m length new 63 diam perforated pipe to the existing leakage detection system and manhole (see detail drawing)</b>	m <sup>2</sup>	2 900		
150.3	PS GM 6	Supply and install 1,5 mm HDPE Smooth Geomembrane. The geomembrane thickness specified shall be minimum nominal thickness, as measured in accordance with the SANS 1526:2003;	m <sup>2</sup>	3 300		
150.4	PS GT 3.1	Supply and install a non-woven needle punched protection geotextile (1200g/m <sup>2</sup> ) to protect the geomembrane from the concrete filled geocells protection system.	m <sup>2</sup>	3 300		
150.5	PS GS 5.1	Supply and install 75mm HDPE Geocells as <b>pond liner and edge protection system filled with a 10MPa concrete with the following anchor system.</b>	m <sup>2</sup>	3 300		
150.51		- <b>Excavate, supply and fill anchor trench 1m x1m with 20Mpa concrete. Trench to include 75mm diam GMS pipe as Deadman anchor along the length of the trench</b>	m	25		

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



Continued...

ITEM NO	PAYMENT REFERS TO	DESCRIPTION	UNIT	QUAN-TITY	RATE	AMOUNT
150.52	PS GM 8.3.4	Excavate, supply and fill anchor trench 600mm x 600mm with 20Mpa concrete. Trench to include 75mm diam GMS pipe as Deadman anchor along the length of the trench	m	25		
150.53		Supply 9,3kN minimum breaking strength Tendons complete with tendon clips to be anchored to the 1mx1m anchor beam space at 300mm c/c	m	1125		
150.54		Supply 6,7kN minimum breaking strength Tendons complete with tendon clips to be anchored to the 600mmx600mm anchor beam space at 450mmc/c	m	600		
150.6		Fabricate, supply and installation of "top hat" type pipe boots for penetrations through all liner components, including sealing to HDPE pipe not greater than 160 mm DN, using stainless steel clamp and rubber seal	Nr.	2		
		<b>TOTAL: CELL LINER REPAIR AND INSTALLATION CARRIED TO SUMMARY</b>				

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



SUMMARY OF BILL OF QUANTITIES	
ITEM	AMOUNT
Total for Bill No 1: Preliminary and General	
Total for Bill No 2: Site clearance	
Total for Bill No 3: Liner repair in cell	
Total for Bill No 4: Pond Liner Repair and Installation	
SUB TOTAL	
VAT (15%)	
TOTAL TENDER PRICE (TO FORM OF TENDER)	

\_\_\_\_\_  
Name of Bidder

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

**BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

**MCM:**

Initial: MCM .....



## MUNICIPAL COUNCIL OF MBABANE

DEPARTMENT NAME: **TECHNICAL SERVICES**

### Tender No: 31-2018/2019

FOR

**REPLACEMENT OF MBABANE SANITARY LANDFILL LEACHATE POND LINER AND REPAIRS TO THE LANDFILL BASE LINER**

### PART C3 PROJECT SPECIFICATION

#### PROJECT SPECIFICATIONS - CONTENTS

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C3.2 STATUS	93

#### PORTION 1 : THE WORKS

	93
PS 1	GENERAL DESCRIPTION
PS 2	DESCRIPTION OF SITE AND ACCESS
PS 3	NATURE OF GROUND AND SUBSOIL CONDITIONS
PS 4	DETAILS OF CONTRACT
PS 5	CONSTRUCTION PROGRAMME
PS 6	SITE FACILITIES AVAILABLE .
PS 7	SITE FACILITIES REQUIRED
PS 8	FEATURES REQUIRING SPECIAL ATTENTION
PS 9	CERTIFICATES OF PAYMENT
PS 10	CONSTRUCTION IN RESTRICTED AREAS
PS 11	DRAWINGS
PS 12	SAMPLES
PS 13	NOTICES, SIGNS, BARRICADES AND ADVERTISEMENTS
PS 14	WORKMANSHIP AND QUALITY CONTROL
PS 15	EXTENSION OF TIME DUE TO ABNORMAL RAINFALL
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PS 18	NON-WORKING DAYS
PS 19	ALTERNATIVE STRUCTURAL DESIGNS
PS 20	INFORMATION REGARDING ELECTRICAL SUBCONTRACT
PS 21	TRANSPORT OF MATERIAL
PS 22	EMPLOYMENT OF LOCAL LABOUR
PS 23	NOMENCLATURE
PS 24	APPLICABLE STANDARDISED SPECIFICATIONS

Features requiring special attention  
Care damage and protection  
Source of construction material

#### BIDDER:

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

#### MCM:

Initial: MCM .....



**PORTION 2: VARIATIONS AND ADDITIONS TO THE STANDARDISED SPECIFICATIONS FOR THIS CONTRACT, AND PARTICULAR SPECIFICATIONS**

102

PSA      GENERAL

PSC      SITE CLEARANCE

PARTICULAR SPECIFICATION PS GCDC      :    GEOSYNTHETIC CUSPATED DRAINAGE LAYER)

PARTICULAR SPECIFICATION PS GM      :    GEOMEMBRANE MATERIAL

PARTICULAR SPECIFICATION PS GS      :    GEOSYNTHETIC GEOCELLS

PARTICULAR SPECIFICATION PS GT      :    GEOTEXTILE MATERIAL

**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**

**Initial:** MCM .....



## PROJECT SPECIFICATIONS

### SCOPE

These Project Specifications are set out in two portions. Portion 1 covers the general description of the project, the facilities available and the requirements to be met. Portion 2 covers variations and additions to the SABS 1200 Standardised Specifications that are applicable to this Contract.

### STATUS

In the event of any discrepancy between the Project Specifications and a part or parts of the SABS 1200 Standardised Specifications, the Schedule of Quantities or the Drawings, the Project Specifications shall take precedence.

## PORTION 1: THE WORKS

### PS 1 GENERAL DESCRIPTION

The contract encompasses the repairs to the existing sanitary landfill base geomembrane liner and the repair and improvement of the leachate pond liner.

### PS 2 DESCRIPTION OF SITE AND ACCESS

The Site of the Works is fairly steep in places and the maximum grade of the general terrain is approximately 11%. Access to the works area is along the existing disposal cell access road. Both the repairs and improvement work has to be done on the existing landfill cell base and leachate pond respectively, where operations are continuous around the area of concern. The works area will be separated from the daily activities.

### PS 3 NATURE OF GROUND AND SUBSOIL CONDITIONS

The current geomembrane liner is covered in some places with drainage stone. The liner is laid a top of the natural granitic gravel surface overlain with a geotextile fabric.

The existing pond barrier system consist of a 1mm primary HDPE liner and a 1mm secondary HDPE liner separated by a 100mm sand layer as the leachate leakage detection layer draining into a leakage detection manhole. The secondary liner laid on top of a U44 Bidum geotextile, 100mm 13mm stone drainage layer on top of a U24 Bidum geotextile layer. Beneath the geotextile layer is a subsoil drainage system that drains to the water course. The recent assessment has found the primary liner to be extensively damaged, hence the need for repairs.

### PS 4 DETAILS OF CONTRACT

The work to be carried out under this Contract mainly consists of the following:

#### **Existing cell liner**

- (a) Clearing away and stockpiling the existing drainage stone.
- (b) Cutting away and removing the damaged geomembrane liner sections
- (c) Cutting away and removing the damaged geotextile liner material
- (d) Making good bottom gravel surface to allow placing of the liner materials
- (e) Supply and install new geotextile material
- (f) Supply and install Geomembrane liner where old liner had been damaged.

#### **BIDDER:**

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2. ....

**Witness:** .....

#### **MCM:**

**Initial:** MCM .....



- (g) Replace drainage stone on top of liner materials

#### **Leachate Pond**

- (a) Clearing of water body (leachate) and silt / settlements inside the pond and safely dispose at the existing landfill cell.
- (b) Repairing the existing primary liner at the base and some obvious breaches on the side slopes
- (c) Supply and install 15 mm Cusped geocomposite drainage system on top of the existing primary liner to form a new leachate leakage detection system and connect to the existing leachate detection manhole
- (d) Supply and install 1,5 mm HDPE Smooth Geomembrane. The geomembrane thickness specified shall be minimum nominal thickness, as measured in accordance with the SANS 1526:2003;
- (e) Supply and install a non-woven needle punched protection geotextile (1200g/m2) to protect the geomembrane from the concrete protection system.
- (f) Supply and install 75mm HDPE Geocell pond edge protection filled with a weak concrete. On the outer slopes above the water line polymeric cell filled with gravel to protect the HDPE liner not only against UV exposure but also mechanical damage from machines, etc.;

This description of the Works is not necessarily complete and shall not limit the work to be carried out by the Contractor under this Contract.

Approximate quantities of each type of work are given in the Schedule of Quantities.

#### PS 5 CONSTRUCTION PROGRAMME

All tenderers are required to submit a preliminary outline of their planned programme together with their tender. After the award of the tender, it will then be required of the successful tenderer to submit for approval to the engineer, the detailed construction programme he intends following, and which must reach the engineer within fourteen (14) days after receipt of the official written notification of the award of the tender.

#### PS 6 SITE FACILITIES AVAILABLE

##### PS 6.1 CAMP SITE

A specific Site will be allocated to the Contractor for his construction camp and offices.

##### PS 6.2 WATER, ELECTRICITY AND SEWERAGE (see example under PS 7.3 if facilities not available)

Water, electricity and sewerage services are available in the vicinity of the Site, and the Contractor shall, at his own expense, be responsible for connections to the available services, as well as for the distribution of water and electricity for construction and domestic use. The distribution of water and electricity shall be carried out in accordance with the applicable laws and regulations.

The Contractor shall make his own arrangements with the appropriate authority for water and electricity and sewerage connections.

See Subclause PSA 4.2 in connection with toilet requirements.

#### PS 7 SITE FACILITIES REQUIRED

##### PS 7.1 FACILITIES FOR THE ENGINEER

No special facilities required.

##### PS 7.2 HOUSING FOR ENGINEER'S REPRESENTATIVE

No special facilities required.

#### **BIDDER:**

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**Witness:** .....

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**Initial:** MCM .....





PS 7.3 WATER, ELECTRICITY AND SEWERAGE

The Contractor shall, at his own expense, be responsible for obtaining and distributing the water and electricity required for construction and domestic use. The distribution of water and electricity shall be carried out in accordance with the applicable laws and regulations.

No separate payment will be made for obtaining and distributing water and electricity, the cost of which will be deemed to be included in the tendered rates.

See Subclause PSA 4.2 in connection with toilet requirements.

PS 7.4 SITE INSTRUCTION BOOK

A triplicate book for Site Instructions shall at all times be kept on the Site.

PS 8 FEATURES REQUIRING SPECIAL ATTENTION

PS 8.1 SITE MAINTENANCE

During progress of the work and upon completion thereof, the Site of the Works shall be kept and left in a clean and orderly condition. The Contractor shall store materials and equipment for which he is responsible in an orderly manner, and shall keep the Site free from debris and obstructions.

PS 8.2 TESTING AND QUALITY CONTROL

The Contractor shall engage the services of an approved independent laboratory for the testing of materials and the quality testing of layer works, to ensure that his work complies with the Specifications.

No separate payment will be made for such testing, the cost of which will be deemed to be included in the Contractor's tendered rates for the items of work that require testing in accordance with the Specifications.

PS 8.3 SUBCONTRACTORS

In addition to the requirements of Clause 4.4 of the General Conditions of Contract, the Contractor shall be responsible for work carried out by subcontractors on his behalf. The Engineer will not liaise directly with such subcontractors. Problems related to payments, programming, workmanship, etc, shall be the concern of the Contractor and the subcontractor, and the Engineer will not become involved.

PS 8.4 ACCESS TO PROPERTIES

The Contractor shall organise the work to cause the least possible inconvenience to the public and to the property owners adjacent to or affected by the work.

If, as a result of restricted road reserve widths and the nature of the work, the construction of bypasses is not feasible, construction shall be carried out under traffic conditions to provide access to erven and properties.

The Contractor may, with the approval of the Engineer, make arrangements with the occupiers of erven and properties to close off part of a street, road, and footpath or entrance temporarily, provided that the Contractor duly notifies the occupiers of the intended closure and its probable duration and re-opens the route as punctually as possible. Where possible, the road shall be made safe and re-opened to traffic overnight. Such closure shall not absolve the Contractor from his obligations under the Contract to provide access at all times. Barricades, traffic signs and drums shall be provided by the Contractor to suit the specific conditions.

PS 9 CERTIFICATES OF PAYMENT

The statement to be submitted by the Contractor in terms of Clause 6 of the General Conditions of Contract shall be prepared in accordance with the standard payment certificate prescribed by the Engineer and shall comprise at least five sets of A4-sized paper copies.

**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

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**Witness:** .....

**MCM:**

**Initial:** MCM .....



All costs for the preparation and submission of the statements shall be borne by the Contractor.

PS 10 CONSTRUCTION IN RESTRICTED AREAS

Working space is sometimes restricted. The construction method used in these restricted areas largely depends on the Contractor's Plant. However, the Contractor must note that measurement and payment will be according to the specified cross-sections and dimensions irrespective of the method used, and that the rates and prices tendered will be deemed to include full compensation for difficulties encountered while working in restricted areas. No extra payment nor any claim for payment due to these difficulties will be considered.

PS 11 DRAWINGS

All information in the possession of the Contractor that is required by the Engineer's representative to complete the as-built drawings must be submitted to the Engineer's representative before a Certificate of Completion will be issued.

Only figured dimensions shall be used and drawings shall not be scaled unless required by the Engineer. The Engineer will provide the dimensions that may have been omitted from the Drawings.

PS 12 SAMPLES

Materials or work that does not conform to the approved samples, submitted in terms of Subclause 7.2 of the General Conditions of Contract, will be rejected. The Engineer reserves the right to submit samples to tests to ensure that the material represented by the sample meets the specification requirements.

PS 13 NOTICES, SIGNS, BARRICADES AND ADVERTISEMENTS

Notices, signs and barricades, erected, as well as advertisements may be used only if approved by the Engineer. The Contractor shall be responsible for their supply, erection, maintenance and ultimate removal and shall make provision for this in his tendered rates.

The Engineer has the right to have any sign, notice or advertisement moved to another position or to have it removed from the Site of the Works should it in any way prove to be unsatisfactory, inconvenient or dangerous to the general public.

The standard name-board of the South African Association of Consulting Engineers is specified, the cost of which shall be included in the rates tendered for items PSA 8.3.1 and PSA 8.3.2 of Section 1200 A.

PS 14 WORKMANSHIP AND QUALITY CONTROL

The onus to produce work that conforms in quality and accuracy of detail to the requirements of the Specifications and Drawings rests with the Contractor, and the Contractor shall, at his own expense, institute a quality-control system and provide experienced Engineers, foremen, surveyors, materials technicians, other technicians and technical staff, together with all transport, instruments and equipment to ensure adequate supervision and positive control of the Works at all times.

The cost of supervision and process control, including testing carried out by the Contractor, will be deemed to be included in the rates tendered for the related items of work.

The Contractor's attention is drawn to the provisions of the various Standardised Specifications regarding the minimum frequency of testing required. The Contractor shall, at his own discretion, increase this frequency where necessary to ensure adequate control.

On completion and submission of every part of the work to the Engineer for examination, the Contractor shall furnish the Engineer with the results of the relevant tests, measurements and levels to indicate compliance with the Specifications.

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....  
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**MCM:**  
Initial: MCM .....

**Witness:** .....



.Below are the values that must be used for determining the extension of time due to abnormal rain.

MONTH	Rn	Nn	
JANUARY	72	9	
FEBRUARY	81	10	
MARCH	57	9	
APRIL	42	6	
MAY	9	3	
JUNE	9	2	X = 10 mm
JULY	5	1	Y = 5 mm
AUGUST	9	2	
SEPTEMBER	6	2	
OCTOBER	24	4	
NOVEMBER	42	7	
DECEMBER	42	7	

The extension of time V has been calculated for each month and year of the period concerned to indicate the possible effect of the rainfall formula. The values of V were obtained by applying the rainfall formula and using the actual rainfall figures and the calculated values of Rn and Nn indicated in the table

**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

2. ....

**Witness:** .....

**MCM:**

**Initial:** MCM .....



# RAINFALL TABLE

Station Name: MBABANE

Data Type Total Monthly

Data Measured In: Millimeters

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Rainfall	5 year average
1961	58.70	208.70	116.00	162.90	26.20	36.10	12.50	16.50	73.90	137.50	254.00	248.00	1351.00	
1962	199.00	68.50	95.50	93.50	0.00	5.50	1.50	65.50	32.00	52.20	320.50	181.50	1115.20	
1963	300.00	189.80	111.00	87.00	25.00	136.00	59.00	0.00	9.50	99.20	96.50	143.00	1256.00	
1964	255.00	106.50	59.50	82.00	18.10	12.00	1.20	3.30	23.20	240.10	164.70	259.90	1225.50	
1965	217.50	68.50	131.60	60.00	20.80	16.70	4.00	85.70	50.70	93.70	176.90	135.40	1061.50	1201.84
1966	426.30	280.70	34.90	38.90	51.00	37.50	4.40	44.50	48.90	156.70	170.20	251.90	1545.90	1240.82
1967	200.60	536.90	100.50	187.80	21.90	0.50	14.00	1.90	9.40	99.90	217.40	154.40	1545.20	1326.82
1968	132.80	100.40	164.90	138.10	24.00	21.50	29.40	30.50	50.90	77.40	216.50	62.60	1049.00	1285.42
1969	260.30	196.50	243.30	159.30	55.00	9.00	11.30	1.10	161.00	306.50	164.00	262.20	1829.50	1406.22
1970	72.90	154.90	77.40	25.50	42.40	2.60	6.80	30.00	39.20	154.90	259.20	151.80	1017.60	1397.44
1971	459.90	131.40	253.90	71.90	38.40	18.70	24.80	10.50	80.90	225.00	140.50	234.10	1690.00	1426.26
1972	391.20	478.00	234.20	76.40	153.20	10.00	5.30	28.00	56.60	51.10	177.10	138.90	1800.00	1477.22
1973	160.60	206.80	92.90	154.00	25.20	3.30	24.00	43.50	199.00	168.50	167.80	283.00	1528.60	1573.14
1974	347.50	87.20	121.70	148.40	24.50	9.50	59.20	6.30	23.80	91.00	222.40	143.20	1284.70	1464.18
1975	283.20	304.10	164.00	73.20	3.60	10.40	2.10	18.80	66.20	126.50	251.00	423.50	1726.60	1605.98
1976	331.40	288.30	187.00	96.30	109.80	0.00	9.40	19.80	13.50	162.00	223.60	262.70	1703.80	1608.74
1977	224.40	387.60	208.10	50.10	14.00	0.00	0.00	57.80	141.00	85.90	236.20	336.30	1741.40	1597.02
1978	420.00	225.10	232.10	56.90	28.40	6.30	60.90	35.70	51.10	147.20	241.60	161.70	1667.00	1624.70
1979	197.10		61.50	83.80	7.60	1.70	17.70	53.70	72.30	124.60	213.40	277.10	1110.50	1589.86
1980	453.70	292.30	51.20	67.10	23.40	0.00	0.20	64.10	154.00	76.40	236.20	134.30	1552.90	1555.12
1981	204.90	257.00	235.50	14.60	127.40	20.90	9.50	37.60	123.00	155.90	206.50	130.00	1522.80	1518.92
1982	279.80	93.30	78.10	101.60	22.30	0.00	5.40	6.00	26.00	137.70	166.40	122.60	1039.20	1378.48
1983	154.20	78.30	143.70	63.80	52.10	6.70	33.80	121.00	48.80	109.80	265.20	230.10	1307.50	1306.58
1984	703.20	72.10	302.70	66.90	7.00	40.40	180.50	34.40	37.80	155.70	234.80	181.90	2017.40	1487.96
1985	123.30	555.20	108.60	19.70	28.90	6.30	0.60	7.90	87.40	202.90	155.30	240.00	1536.10	1484.60

**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....

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**Witness:** .....

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**Initial:** MCM .....



1986	160.80	168.70	148.10	170.10	10.30	12.00	0.30	24.60	43.40	63.40	93.40	291.30	1186.40	1417.32
1987	138.90	100.20	208.10	58.50	16.80	14.00	0.20	93.20	201.00	168.10	193.80	201.20	1394.00	1488.28
1988	87.30	397.90	198.50	86.10	7.90	60.30	21.20	46.90	80.10	303.20	129.20	265.50	1684.10	1563.60
1989	119.40	414.50	124.60	51.90	19.50	83.70	3.60	12.90	51.70	189.60	228.70	136.40	1436.50	1447.42
1990	230.70	227.90	169.70	90.60	9.00	0.00	0.00	52.40	27.00	94.30	108.10	163.70	1173.40	1374.88
1991	580.00	169.50	385.40	3.80	125.20	53.60	5.60	22.60	32.10	98.10	280.60	198.40	1954.90	1528.58
1992	112.60	92.30	69.30	21.20	0.00	15.50	1.00	4.80	60.10	133.30	147.80	330.80	988.70	1447.52
1993	152.80	278.10	261.40	76.80	55.20	4.20	3.80	60.80	46.70	157.40	95.90	210.90	1404.00	1391.50
1994	276.90	167.00	251.80	33.40	12.70	2.50	5.80	21.70	31.20	127.80	126.30	174.30	1231.40	1350.48
1995	175.00	121.80	141.10	82.70	7.20	5.50	4.60	18.00	21.70	94.50	215.00	335.30	1222.40	1360.28
1996	311.70	365.10	161.90	98.10	73.20	1.10	51.80	35.50	14.40	165.70	112.90	189.50	1580.90	1285.48
1997	236.50	171.10	235.30	28.10	66.60	41.50	15.70	33.10	81.00	171.80	200.30	170.90	1451.90	1378.12
1998	281.50	198.30	132.70	66.80	4.10	0.00	19.40	11.00	104.00	271.80	244.70	340.90	1675.20	1432.36
1999	126.10	245.50	148.10	72.10	28.20	5.50	10.90	42.50	54.60	123.70	248.20	343.60	1449.00	1475.88
2000	348.70	691.10	305.50	174.30	90.30	14.00	9.20	2.40	105.00	168.70	367.20	218.20	2494.60	1730.32
2001	110.50	226.30	166.20	171.30	27.90	14.90	36.60	2.90	66.60	129.80	322.80	115.70	1391.50	1692.44
2002	190.60	158.10	127.60	30.00	10.90	21.70							538.90	1509.84
Average	249.94	233.21	162.98	83.23	36.08	18.13	18.71	31.94	65.87	143.89	202.26	215.53	1461.76	
Long-term	253.15	230.25	148.63	87.90	33.79	19.37	20.09	35.13	69.41	141.90	197.80	206.94	1444.36	

#### DESIGN RAINFALL DEPTHS AT SELECTED STATIONS IN SOUTH AFRICA

SAWB NUMBER	Station Name	Latitude (°) (')	Longitude (°) (')	MAP (mm)	Altitude (m)	Years	Duration (days)	Return Period (years)																				
								2			5			10			20			50			100			200		
								L	D	U	L	D	U	L	D	U	L	D	U	L	D	U	L	D	U	L	D	U
0482229 W	MBABANE	26 19	31 8	1158	1273	92	1	86	86	87	119	120	121	144	146	147	171	173	176	209	214	220	242	248	257	277	285	300
							2	112	113	114	157	158	159	190	193	195	226	230	236	278	286	298	323	334	353	371	387	416
							3	126	128	129	178	180	181	216	220	223	256	263	270	314	326	341	364	380	405	418	441	479
							4	139	141	142	196	198	199	237	241	245	280	287	295	341	355	371	395	412	440	449	476	517
							5	152	154	155	212	214	216	256	260	264	300	308	317	362	377	394	415	434	462	469	497	538
							6	160	162	164	224	226	228	269	273	277	315	323	332	381	394	412	433	453	481	486	516	560
							7	169	171	173	236	238	240	283	287	292	331	339	350	398	414	434	454	476	508	511	543	590

L=lower 90% error bound (mm); D=deign rainfall depth (mm); U=upper 90% error bound (mm)

#### **BIDDER:**

Initial: Authorized signatory/ies: 1. ....

2. ....

Witness: .....

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Initial: MCM .....



PS 16 SPOIL MATERIAL

No indiscriminate spoiling of material is permitted. Surplus or unsuitable materials shall be spoiled in designated areas as directed by the Engineer.

PS 17 TRENCHES

Trenches may not be left open during the builders' holidays.

PS 18 NON-WORKING DAYS

The Contractor shall not work on any statutory public holidays or on any public holidays declared by the government to be statutory non-working days.

PS 20 INFORMATION REGARDING LINER SUBCONTRACT

The INSTALLATION OF BOTH THE LANDFILL LINER AND LEACHATE POND LINER to be carried out by a Nominated Specialist Subcontractor comprises the installation of the environmental barrier or liner system in the earthworks formed landfill cell.

The main Contractor will be required to do the excavation, formation and embankment construction, excavation and construction of the subsoil and leachate drainage system and the anchor beams for the landfill cell, backfill where required, the supply and laying of the drainage stone on top of the liner system where so instructed and the clearing up of the cell area after the installation of the liner.

The main Contractor shall allocate sufficient machines for excavation of the landfill cell and associated trenches for leachate, subsoil drainage and stormwater piping so that excavation may proceed without delay when required. When these machines are not required for the excavation of the landfill cell and piping, they may be used for other purposes.

The Contractor shall, as the main Contractor, be responsible for execution of the complete Works and he will be notified as soon as possible who the successful subcontractor is, so that he may enter into a subcontract with the Nominated Subcontractor without delay.

It is emphasised that although the Contractor and the subcontractor may negotiate mutually acceptable conditions to be included in the subcontract, such conditions are not binding on the Employer as only the General and Special Conditions of Contract that form part of these Contract Documents apply to the execution of the Works.

The Contractor shall be held liable for payment of the penalty amount shown in the Appendix to the Tender should the Contract not be completed on time, even if the subcontractor is responsible for the late completion.

All negotiations on Site between the Engineer and the Nominated Subcontractor will take place via the Contractor.

A Provisional Sum has been provided in Section 1200 A of the Schedule of Quantities to cover the cost of the liner work and the Contractor is afforded the opportunity to Tender a percentage of the Provisional Sum to cover the cost of his charges, profits and responsibilities regarding the specialist liner subcontractor.

Payments due to the subcontractor will be paid directly to the subcontractor by the Employer on submission of Payment Certificates signed by both Contractors and endorsed by the Engineer.

The Tender Document for the Nominated Subcontractor will be made available with the civil tender document and the civil tender document will be made available with the Tender Document for the Nominated Subcontractor.

PS 21 TRANSPORT OF MATERIAL

All costs for transporting materials, including overhaul, shall be included in the applicable tendered rates. All references in the Specifications to transport, overhaul and haul distances shall be deleted irrespective of whether or not the deletion is included in these Project Specifications.

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PS 22                      EMPLOYMENT OF LOCAL LABOUR

It is the intention that this Contract should make maximum use of the local labour force that is presently underemployed. For the purposes of this contract, "local labour" will be deemed to be any persons who resides within ward 1. The contractor will be required to provide proof of authenticity of local labour signed by the Council CLO.

To this end the Contractor is expected to limit non-local employees to key personnel only and to employ and train local labour on this Contract.

The Contractor shall fill in the form: Key Personnel, and state how many non-local key personnel he intends to employ in the various categories.

The numbers stated on the above-mentioned form will be strictly controlled during the Contract period and any increase in numbers is subject to the approval of the Employer.

PS 23                      NOMENCLATURE

Any reference to a South African law in the Contract Documents shall be read as a reference to the equivalent law of the Kingdom of Eswatini.

PS 24                      APPLICABLE STANDARDISED SPECIFICATIONS

For the purposes of this Contract, the following SABS 1200 Standardised Specifications shall apply:

SABS 1200 A	:	General (1986)
SABS 1200 C	:	Site clearance (1982)
SABS 1200 G	:	Concrete

Variations and additions to the following SABS 1200 Standardised Specifications are given in Portion 2 of the Project Specifications:

SABS 1200 A	:	General
SABS 1200 C	:	Site clearance
SABS 1200 G	:	Concrete

The following particular specifications for work not covered by the SABS 1200 Standardised Specifications are also bound in Portion 2 of the Project Specifications:

PS GCDC	:	Geosynthetic cusped drainage layer
PS GM	:	Geomembrane sheeting (Liner)
PS GS	:	Geocells Reinforcement Material
PS GT	:	Geotextile sheeting

In the event of any discrepancy between a part or parts of the standard or particular specifications and the project specification, the project specification shall take precedence. In the event of discrepancy between all specification (including the project specification), the drawings and / or the Bill of Quantities, the discrepancy shall be resolved by the Engineer before the execution of the work under the relevant item.

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**PORTION 2: VARIATIONS AND ADDITIONS TO THE STANDARDISED SPECIFICATIONS FOR THIS CONTRACT, AND PARTICULAR SPECIFICATIONS**

The following variations and additions to the SABS 1200 Standardised Specifications referred to in the last clause of Portion 1 apply to this Contract. The prefix PS indicates an amendment to SABS 1200. The letters and numbers following these prefixes respectively indicate the relevant Standardised Specification and clause numbers in SABS 1200.

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**Initial:** Authorized signatory/ies: 1. ....  
2. ....

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PSA                      GENERAL

PSA 1 SCOPE

*REPLACE SUBCLAUSE 1.1 WITH THE FOLLOWING:*

"1.1 This specification covers requirements, principles and responsibilities of a general nature that are normally applicable to all civil engineering contracts, as well as the requirements for the Contractor's establishment on the Site."

PSA 2 INTERPRETATIONS

PSA 2.3                      DEFINITIONS

(a) General

*ADD THE FOLLOWING DEFINITIONS:*

"General conditions: The General Conditions of Contract specified for use with this Contract and the special conditions of Contract as applicable.

Specified: As specified in the standardised specifications, the Drawings or the Project Specifications. Specifications shall have the corresponding meaning."

(c) Measurement and payment

*REPLACE THE DEFINITIONS FOR "fixed charge", "time-related charge" AND "value-related charge" WITH THE FOLLOWING:*

"Fixed charge: A charge that is not subject to adjustment on account of variation in the value of the Contract amount or the Contract Time of Completion.

Time-related charge: A charge, the amount of which varies in accordance with the Time for Completion of the work, adjusted in accordance with the provisions of the Contract.

Value-related charge: A charge, the amount of which varies pro rata with the final value of the measured work executed and valued in accordance with the provisions of the Contract."

PSA 2.4                      ABBREVIATIONS

(a) Abbreviations relating to standard documents

*ADD THE FOLLOWING ABBREVIATION:*

"CKS: SABS Co-ordinating Specification."

PSA 3 MATERIALS

PSA 3.1                      QUALITY

*ADD THE FOLLOWING:*

"All manufactured materials supplied shall be new materials unless the contrary is specified. All materials specified in accordance with SABS Specifications shall bear the SABS mark, whether so specified or not."

*ADD THE FOLLOWING SUBCLAUSES:*

"PSA 3.3                      ORDERING OF MATERIALS

**BIDDER:**

**Initial:** Authorized signatory/ies: 1. ....  
2. ....

**Witness:** .....

**MCM:**

**Initial:** MCM .....



The quantities set out in the Schedule of Quantities have been carefully determined from calculations based on data available at the time and should therefore be considered to be approximate quantities only. Before ordering materials of any kind the Contractor shall check with the Engineer whether or not the scope of the work for which the materials are required is likely to change substantially. No liability or responsibility whatsoever shall be attached to the Employer for materials ordered by the Contractor except when ordered in accordance with written confirmation issued by the Engineer.

PSA 3.4 MATERIALS SUPPLIED BY THE EMPLOYER

Materials designated in the Contract documents to be supplied by the Employer shall not be obtained by the Contractor from any other source than from the Employer. Requisitions for materials to be supplied by the Employer shall be submitted in writing and shall be signed by the Contractor or his authorised representative and the Engineer. The Contractor or his authorised representative shall sign a receipt upon delivery of all such materials that, having been accepted by the Contractor, will be deemed to be in a sound and satisfactory condition and will thenceforth be his sole responsibility.

The onus shall be entirely on the Contractor to ensure that he accepts only sound materials from the Employer, and the Engineer is authorised to reject as unsuitable any material on the Site of the Works that, in his opinion, is unsound or defective in any way. The Contractor shall immediately remove such rejected materials from the Site of the Works and shall replace them, at his own expense, with new and sound materials to the satisfaction of the Engineer."

PSA 4 PLANT

PSA 4.2 CONTRACTOR'S OFFICES, STORES AND SERVICES

*ADD THE FOLLOWING PARAGRAPH BEFORE THE FIRST PARAGRAPH:*

"The Contractor's construction camp shall be fenced off and shall contain all offices, stores, workshops, testing laboratories, toilet facilities, etc. The camp shall always be kept in a neat and orderly condition.

No personnel may reside on the Site. Only night-watchmen may be on the Site after hours."

*ADD THE FOLLOWING TO THE SECOND PARAGRAPH:*

"One toilet per 10 workmen shall be provided and must be screened from public view and its use shall be enforced.

The Contractor shall, where applicable, make the necessary arrangements for the removal of night soil."

PSA 5 CONSTRUCTION

PSA 5.4 PROTECTION OF OVERHEAD AND UNDERGROUND SERVICES

*REPLACE THE HEADING AND THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:*

"PSA 5.4 LOCATION AND PROTECTION OF EXISTING SERVICES

PSA 5.4.1 Location of existing services

Before underground or excavation work is carried out, the Contractor shall ascertain the presence and position of all services likely to be damaged or interfered with by his activities. He shall obtain up-to-date plans from the Engineer for this purpose, showing the position of services in the area where he intends to work. As services can often not be reliably located from such plans, the Contractor shall determine the exact position of such services by means of suitable detecting equipment and afterwards by careful hand excavation where necessary in order to expose the services at the positions of possible interference by his activities. This procedure shall also be followed in respect of services not shown on the plans but believed to be present.

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All such services, the positions of which have been located at the critical points, shall be designated as 'known' services and their positions shall be indicated on a separate set of Drawings, a copy of which shall be furnished to the Engineer.

While he is occupying the Site, the Contractor shall be liable for all damage caused by him to known services as well as for consequential damage, whether caused directly by his operations or by the lack of proper protection.

PSA 5.4.2      Protection during construction

The Contractor shall exercise all the necessary care to prevent damage to known services during construction operations. Major excavating equipment and other Plant shall not be operated dangerously close to these services. Where necessary, excavation in close proximity to these services shall be carefully carried out with suitable hand tools, excluding picks wherever their use could damage the services. No additional payment will apply to such more difficult work.

Services left exposed shall be suitably protected from damage.

PSA 5.4.3      Alterations and repairs to existing services

Unless the contrary is clearly specified or ordered, the Contractor shall not carry out alterations to existing services. When this is necessary, the Contractor shall inform the Engineer, who will either make arrangements for such work to be executed by the owner of the service, or instruct the Contractor to make such arrangements himself.

When existing services are damaged by the Contractor, he shall immediately inform the Engineer, or when this is not possible, the relevant authority, and obtain instructions as to who should carry out repairs. In urgent cases the Contractor shall take the necessary steps to minimise damage to and interruption of the service. No repairs of telecommunication cables or electric power lines and cables shall be attempted.

A list of important telephone numbers for use when services are damaged or need to be altered is provided below:

Electricity	:	.....
Water	:	.....
Sewerage	:	.....
Traffic	:	.....

The Employer will accept no liability for damages due to a delay in having such alterations or repairs effected. The Contractor shall provide all reasonable opportunity, access and assistance to persons carrying out alterations or repairs of existing services."

"PSA 5.7      SAFETY

*ADD THE FOLLOWING SUBCLAUSES:*

"The Contractor will refer to section, C3.4, Particular specification, for the Occupational Health and Safety Act (OHSA: 1993) Safety Specifications."

AND

"The contractor shall provide security watchman and all measures necessary to secure the works for the contract as he deems fit. The cost thereof will be deemed to be included in the relevant rates tendered. The Contractor must ensure that all his employees as well as the employees of his subcontractors are able to identify themselves as members of the construction team."

THE MBABANE SANITARY LANDFILL SITE is an operational site, **landfill gas** (Containing methane) may be generated within the site and leachate collection system.

**BIDDER:**

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NAKED FLAMES AND SMOKING IS NOT PERMITTED anywhere on the Landfill Site and due care should be taken, in compliance with all the laws, when working on the Site.

DUE CARE AND DILIGENCE should also be exercised when work is carried out in the vicinity and/or adjacent to the previous disposal areas.

ALL LIQUIDS emanating from the landfill and surroundings are deemed to be **dangerous**. Thus no liquid may be collected or use for any purpose whatsoever.

For safety and health reasons, NO SCAVENGING of any materials deposited on the Landfill Site will be permitted. The Contractor shall ensure that all his workers as well as his subcontractors comply with this requirements.

**Contravention of any of the above may be sufficient grounds to remove persons off site.**

"PSA 5.9      SITE MEETINGS

*ADD THE FOLLOWING SUBCLAUSES:*

The Contractor will be required to attend regular site meetings, normally held once a month to discuss general progress, quality of work, problems, claims, payments, etc, but not matters concerning the day-to-day running of the Contract.

PSA 6 TOLERANCES

*ADD THE FOLLOWING SUBCLAUSE:*

"PSA 6.4      GENERAL

No guarantee is given that the full specified tolerances will be available independently of each other, and the Contractor is cautioned that the liberal or full use of any one or more of the tolerances may deprive him of the full or any use of tolerances relating to other aspects of the work.

Except where the contrary is specified or when clearly not applicable, all quantities for measurement and payment shall be determined from the 'authorised' dimensions. These are specified dimensions or those shown on the Drawings or, if changed, as finally prescribed by the Engineer, without any allowance for the specified tolerances. Except if otherwise specified, all measurements for determining quantities for payment will be based on the 'authorised' dimensions.

If the work is therefore constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, quantities will be based on the 'authorised' dimensions regardless of the actual dimensions to which the work has been constructed.

When the work is not constructed in accordance with the 'authorised' dimensions plus or minus the tolerances allowed, the Engineer may nevertheless, at his sole discretion, accept the work for payment. In such cases no payment shall be made for quantities of work or material in excess of those calculated for the 'authorised' dimensions, and where the actual dimensions are less than the 'authorised' dimensions minus the tolerance allowed, quantities for payment shall be based on the actual dimensions as constructed."

PSA 7 TESTING

PSA 7.1      PRINCIPLES

PSA 7.1.1      Checking

*REPLACE THE LAST SENTENCE WITH THE FOLLOWING:*

**BIDDER:**  
Initial: Authorized signatory/ies: 1. ....  
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Initial: MCM .....

**Witness:** .....



"The Contractor shall obtain the services of an independent testing laboratory at his own expense (refer to Clause 8 in Portion 1 of the Project Specifications) to carry out the checks prescribed in the various Standardised Specifications."

PSA 7.1.2      Standard of finished work not to specification

*REPLACE THE WORDS "Where the Engineer's checks reveal ..." WITH "Where the checks by the approved laboratory reveal ..."*

PSA 7.2      APPROVED LABORATORIES

*ADD THE FOLLOWING:*

"The independent laboratory used by the Contractor and approved by the Engineer shall also be deemed an approved laboratory."

## PSA 8 MEASUREMENT AND PAYMENT

PSA 8.1      MEASUREMENT

PSA 8.1.2      Preliminary and general items or section

PSA 8.1.2.2      Tendered sums

*REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:*

"The Contractor's tendered sums under items PSA 8.3 and PSA 8.4 shall collectively cover all charges for

- risks, costs and obligations in terms of the General Conditions of Contract and of this standardised specification, except where provision is made in these Project Specifications to cover compensation for any of these items
- head-office and site overheads and supervision
- profit and financing costs
- expenses of a general nature not specifically related to any item or items of permanent or temporary work
- providing facilities on Site for the Contractor's personnel, including offices, storage facilities, workshops, ablutions, for providing services such as water, electricity, sewerage, sewage and rubbish disposal, for access roads and all other facilities required, as well as for the maintenance and removal on completion of the Works of these facilities and the cleaning-up of the camp site on completion of the Works
- providing facilities for the Engineer and his staff as specified in SABS 1200 AB and in these Project Specifications."

PSA 8.2      PAYMENT

PSA 8.2.1      Fixed-charge and value-related items

*REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:*

"Payment of fixed charges in respect of item 8.3.1 will be made as follows:

80% of the sum tendered will be paid when the facilities have been provided and approved. The remaining 20% will be paid when the Works have been completed, the facilities have been removed and the camp site has been cleared and cleaned.

Payment for the sum tendered under item 8.3.2 will be made in three separate instalments as follows:

- (a) The first instalment, which is 40% of the sum, will be paid when the Contractor has fulfilled all his obligations to date under this Specification, the General Conditions of Contract and the Special Conditions of Contract, and when the value of work certified for payment, excluding materials on Site

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and payments for preliminary and general items, is equal to not less than 5% of the total value of the work listed in the Schedule of Quantities.

- (b) The second instalment, which is 40% of the sum, will be made when the amount certified for payment, including retention monies but excluding this second instalment, exceeds 50% of the Tender Sum.
- (c) The final payment, which is 20% of the sum, will be made when the Works have been certified as completed and the Contractor has fulfilled all his obligations to date under this Specification, the General Conditions of Contract and the Special Conditions of Contract.

Should the value of the measured work finally completed be more or less than the Tender Sum, the sum tendered under item 8.3.2 will be adjusted up or down in accordance with the provisions of Clause 53 of the General Conditions of Contract, and this adjustment will be applied to the third instalment. No adjustment will apply to item 8.3.1 in respect of variations in the value of work done or the finally authorised Time for Completion."

PSA 8.2.2 Time-related items

*REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:*

"Subject to the provisions of Subclauses 8.2.3 and 8.2.4, payment under item 8.4.1 (time-related item) will be made monthly in equal amounts, calculated by dividing the sum tendered for the item by the tendered contract period in months, provided always that the total of the monthly amounts so paid for the item is not out of proportion with the progress of the work as a whole.

Should the Engineer grant an extension of Time for Completion of the Works, the Contractor will be entitled to an increase in the sum tendered for the time-related item, which increase shall be in the same proportion to the original tendered sum as the extension of time is to the original Time for Completion of the Works.

Payment of such increased amounts will be deemed full compensation for all additional time-related preliminary and general costs due to the circumstances pertaining to the extension of time granted."

PSA 8.3 SCHEDULED FIXED-CHARGE AND VALUE-RELATED ITEMS

*REPLACE THE ITEMS WITH THE FOLLOWING:*

"PSA 8.3.1 Fixed preliminary and general charges ..... Unit : Sum

PSA 8.3.2 Value-related preliminary and general charges ..... Unit : Sum

The sums tendered shall include full compensation for all fixed and value-related preliminary and general charges as described in Subclause PSA 8.1.2.2. Payment will be made as described in Subclause PSA 8.2.1."

PSA 8.4 SCHEDULED TIME-RELATED ITEMS

*REPLACE THE ITEMS WITH THE FOLLOWING:*

"PSA 8.4.1 Time-related preliminary and general charges ..... Unit : Sum

The sum tendered shall include full compensation for all time-related preliminary and general charges as described in Subclause PSA 8.1.2.2. Payment will be made as described in Subclause PSA 8.2.2."

PSA 8.5 SUMS STATED PROVISIONALLY BY THE ENGINEER

*REPLACE THE CONTENTS WITH THE FOLLOWING:*

"(a) Electrical work to be executed by a Nominated

**BIDDER:**

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Initial: MCM .....



Subcontractor.....Unit: Prov Sum

(b) Overheads, charges and profit on item (a) above.....Unit : %

The Provisional Sum provided in the Schedule of Quantities for electrical work executed by a Nominated Subcontractor shall be paid in accordance with Clause 48 of the General Conditions of Contract.

The percentage tendered will be paid to the Contractor on the actual amount paid to the subcontractor and shall include full compensation for all costs incurred in fulfilling his contractual role as the main Contractor."

PSA 8.6 PRIME COST ITEMS

*REPLACE THIS ITEM WITH THE FOLLOWING:*

"PSA 8.6 PRIME COST SUMS:

(a) Additional tests required by the Engineer.....Unit : PC Sum

(b) Charge required by Contractor on subitem (a) above.....Unit : %

Note in connection with subitem (a):

The Contractor is responsible for both the cost of normal testing as described in Subclause PS 8.2 in portion 1 of the Project Specifications and for the cost of any additional test that indicates that the Specifications have not been complied with."

PSA 8.8 TEMPORARY WORKS

*REPLACE ITEM 8.8.4 WITH THE FOLLOWING:*

"PSA 8.8.4 Location and protection of existing services:

PSA 8.8.4.1 Provision of detecting devices for:

(a) Water and sewer pipes.....Unit : Sum

(b) Electrical and other cables.....Unit : Sum

The tendered sums shall cover the cost of providing and operating suitable equipment for as long as it is needed to locate all the existing services likely to be affected by the construction activities. Alternatively, an approved specialist firm may be employed to carry out the work.

PSA 8.8.4.2 Hand excavation necessary for locating and exposing existing services in all material:

(a) In roadways.....Unit : m<sup>3</sup>

(b) In all other areas.....Unit : m<sup>3</sup>

The rates shall cover the cost of excavating by means of hand tools within authorised dimensions, for all precautionary measures to protect the services from damage during excavation and backfilling, and for subsequent backfilling and compacting. Compaction of material in all areas except in roadways shall be to 90% of the modified AASHTO density.

The rate for hand excavation in roadways shall include compensation for compacting excavated or selected backfill material to 93% of modified AASHTO density. Reinstating layerworks and surfacing shall be measured and paid for under SABS 1200 DB.

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The tendered rates shall also include for keeping excavations safe, for dealing with surface and subsurface water, for removing surplus excavated material from the Site, for transporting all material within the free-haul distance, and for supplying adequate supervision during both excavation and backfilling operations. Overhaul will be measured and paid for under SABS 1200 DB."

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## PSC SITE CLEARANCE

### PSC 3 MATERIALS

#### PSC 3.1 DISPOSAL OF MATERIAL

*ADD THE FOLLOWING:*

"The Contractor shall obtain his own dumping sites for the disposal of material and all transport costs shall be included in the rates tendered for site clearance."

### PSC 5 CONSTRUCTION

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

*ADD THE FOLLOWING:*

"Pipeline routes shall be cleared to a distance of 1,5 m on both sides of the pipeline centre line. Route pegs or markers shall not be destroyed or damaged during clearing operations."

#### PSC 5.2 CUTTING OF TREES

##### PSC 5.2.3 Preservation of trees

##### PSC 5.2.3.2 Individual trees

*REPLACE THE LAST SENTENCE WITH THE FOLLOWING:*

"An amount of E500,00 will be deducted from moneys due to the Contractor as a penalty for every tree that is damaged or removed unnecessarily."

#### PSC 5.3 CLEARING

*ADD THE FOLLOWING:*

"The Contractor shall Clear the water body (leachate) and silt / settlements inside the pond and safely dispose at the existing landfill cell."

#### PSC 5.5 RECLEARING OF VEGETATION

*ADD THE FOLLOWING:*

"When areas have to be re-cleared on the written instructions of the Engineer, such re-clearing shall be carried out at the Contractor's own cost and the Contractor is therefore advised not to clear the areas too soon."

### PSC 8 MEASUREMENT AND PAYMENT

#### PSC 8.2 PAYMENT

##### PSC 8.2.1 Clear and grub

*REPLACE THE FIRST LINE WITH THE FOLLOWING:*

"The area designated by the Engineer to be cleared and grubbed will be measured in square metre to the nearest square metre or cubic metre"

*ADD THE FOLLOWING ITEMS:*

"PSC 8.2.11 Take down and re-erect existing fences ..... Unit : m

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The rate shall cover the cost of taking down the fences, coiling wire, sorting, stacking and guarding all materials, the cost of loading, transporting and off-loading such materials, the cost of re-erecting the fence in its original position using the dismantled material, the cost of temporary bracing of the fencing sections not taken down and the cost of appurtenant materials that may be required to restore the fence to its original condition before dismantling.

PSC 8.2.12      Remove topsoil to spoil site furnished by Contractor..... Unit : m<sup>3</sup>

The tendered rate shall include full compensation for removing topsoil to a depth of 150 mm and for loading and transporting the material to spoil sites furnished by the Contractor."

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PSG                      CONCRETE (STRUCTURAL)

PSG 3 MATERIALS

PSG 3.2                      CEMENT

PSG 3.2.2                      Alternative types of cement.

*REPLACE THE CONTENTS OF THIS SUBCLAUSE WITH THE FOLLOWING:*

"Only ordinary Portland cement shall be used.

If the Contractor wishes to use any other type of cement, he shall obtain the Engineer's prior written approval (see 8.1.3.2 and 8.1.3.3)."

PSG 3.2.3                      Storage of cement

*ADD THE FOLLOWING:*

"Cement shall not be stored for longer than 12 weeks without the Engineer's permission."

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## **PARTICULAR SPECIFICATIONS**

### **PS GCDC: GEOSYNTHETIC CUSPATED DRAINAGE LAYER**

#### **Content**

PS GCDC 1 Scope  
PS GCDC 2 Interpretations  
PS GCDC 3 Materials and Manufacturing  
PS GCDC 4 Packaging, Transportation, Handling and Storage  
PS GCDC 5 Construction  
PS GCDC 6 Tolerances  
PS GCDC 7 Testing  
PS GCDC 8 Measurement and Payment

#### **PS GCDC 1: Scope**

This is a particular specification and covers the supply and installation of a geosynthetic cusped drainage core (GCDC) to be installed as the leakage detection layer of the geocomposite lining systems for the Sanitary Landfill and Leachate Pond.

#### **PS GCDC 2: Interpretations**

##### **PS GCDC 2.1: Supporting Specifications**

The following supporting specifications, standards and guidelines shall, inter alia, form part of the contract document together with this Particular Specification:

- a) Project Specification
- b) ASTM D4439 Terminology for Geosynthetics
- c) ASTM D638 Standard Test Method for Tensile Properties of Plastics
- d) ASTM D792 Standard Test Method for Specific Gravity and Density of Plastics by Displacement
- e) ASTM D1238 Standard Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer
- f) ASTM D1603 Test Method for Carbon Black in Olefin Plastics
- g) ASTM D1621-04a Standard Test Method for Compressive Properties of Rigid Cellular Plastics
- h) ASTM D7361-07 Standard Test Method for Accelerated Compressive Creep of Geosynthetic Materials Based on Time-Temperature Superposition Using the Stepped Isothermal Method
- i) ASTM D4833-88(1996)e1 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
- j) ASTM D5885 - 06 Standard Test Method for Oxidative Induction Time of Polyolefin Geosynthetics by High-Pressure Differential Scanning Calorimetry

##### **PS GCDC 2.2: Application**

This specification contains clauses that are generally applicable to the manufacture, supply and installation of geosynthetic cusped drainage core (GCDC).

#### **PS GCDC 3: Materials**

##### **PS GCDC 3.1: Properties of Geosynthetic Cusped Drainage Core (GCDC)**

The geosynthetic cusped drainage core to be used as a leakage detection layer within the geocomposite lining system for the Sanitary Landfill and Leachate Pond shall be "Finesse Leakdrain S3U Hyper" as supplied by ABG Ltd or "Hidrain" as supplied by Aquatan, or an equivalent product as approved by the Engineer. It shall consist of a Pure High Density Polyethylene (HDPE) incorporating an evenly dispersed carbon black content as well as time proven Ultra Violet stabilisers and anti-oxidants. Reprocessed or reground materials shall not be used. Specifically, the GCDC shall have the following components and properties:

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- The unit mass of the GCDC shall be approximately 1 000 g/m<sup>2</sup>.
- The equivalent sheet thickness shall be 1 mm (+/-20%)
- The cusp (dimple) height shall be not less than 3.1 mm (+/-20%).
- The cusp (dimple) centres shall be not less than 8 mm (+/-10%).
- Carbon black shall be between 0.8 and 2.5%.
- Usable tensile strength shall be 12 kN/m in both directions.
- Usable compressive strength shall be 600 kPa.
- The long-term creep strain at 600 kPa pressure shall not be more than 25% at 1 million hours (114 years) and 20°C.
- The in-plane water flow at 1 000 kPa vertical pressure shall be not less than 0.45 l/m.sec at a hydraulic gradient of 1.0, and 0.10 l/m.sec at a hydraulic gradient of 0.1.
- The GCDC shall exhibit a High Pressure Oxidative Induction Test (HPOIT) result of at least 400 minutes.

PS GCDC 3.2: Materials Certification

The Lining Contractor shall submit documented certification that the geosynthetic cusped drainage core product supplied complies with the aforementioned specifications. This documentation shall be submitted prior to any installation of the product on site.

PS GCDC 3.3: Materials general

The geosynthetic cusped drainage core product is to be supplied to site in panels no less than 2.2 m wide to minimize the number of site joints required.

The purpose of the geosynthetic cusped drainage core is to provide a drainage path between two geomembrane liners to intercept and drain away any leakage that may occur in the geomembrane liners, and so provide a leakage detection system between the primary and secondary geomembrane liners, as well as between the secondary and tertiary liners. The physical and chemical characteristics of the geosynthetic cusped drainage core product and its jointing system must be such that the integrity of the leakage detection systems is maintained throughout the life of the landfill. As such the geosynthetic cusped drainage core product shall be resistant to degradation as a result of the temperature (nominal) and chemical characteristics of the leachate, sunlight, ultra violet rays, ozone, airborne pollution and weathering.

PS GCDC 4: Packaging, Transportation, Unloading and Storage

The geosynthetic cusped drainage core product shall be packaged, transported, unloaded and stored in accordance with the manufacturer's instructions.

PS GCDC 4.1: Packaging and Transportation

The rolls of geosynthetic cusped drainage core product shall be packaged so as to protect them from mechanical damage during transportation and handling. The GCDC rolls must be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging is to be carefully removed without damaging the product.

PS GCDC 4.2: Unloading

Before off-loading on site, the contractor must ensure that the off-loading equipment is adequate for handling the GCDC rolls without any risk of damaging them. The area where the GCDC is to be off-loaded and stored must have a smooth well-drained surface, free of rocks or any other protrusions which may damage the product. No special covering is necessary for geosynthetic cusped drainage core.

After off-loading, the contractor shall conduct a surface observation of all rolls for defects and for damage. This inspection shall be conducted without unrolling rolls unless defects or damages are found or suspected. The contractor shall inform the engineer and the manufacturer of any defects or damages. Repairs shall be made subject to approval by the engineer, otherwise damaged rolls shall be replaced at the contractor's cost.

PS GCDC 4.3: Storage

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A designated storage area shall be established in a location such that on-site transportation and handling are minimised. The storage area should be protected from theft, vandalism, passage of vehicles, and be adjacent to the area to be lined. The geosynthetic cusped drainage core rolls shall be stored laying flat and continuously supported.

PS GCDC 5: Construction

PS GCDC 5.1: Installation

The Contractor shall submit with his tender a detailed proposal on the method he proposes to use for installation of the geosynthetic cusped drainage core product. Some of the aspects to be covered include:

- A floor plan clearly showing the intended layout of the GCDC, including orientation of strips, and positions of overlaps and joints.
- Placement of the GCDC without disturbance or damage to underlying layers and linings.
- Equipment and procedures used to place the GCDC.
- Placing of the geomembrane liner on top of the GCDC without damaging or disturbing the GCL lining.

At the time of installation, each field panel or portion of a roll of geosynthetic cusped drainage core shall be given an "identification code". Field panels are to be located in a manner consistent with the specification and best suited to the design layout. Field panels are to be placed one at a time, and each field panel is to be seamed immediately after placement to the adjoining panel (in order to minimise the number of unseamed panels). The Contractor shall record the identification code, location and date of installation of each GCDC field panel.

Installation and seaming shall not take place in wet weather or in the presence of excessive moisture, blowing dust, or strong winds.

During installation, the Contractor shall ensure the following:

- Any equipment used shall not damage the geomembrane or geosynthetic cusped drainage core by handling, trafficking, excessive heat, leakage of hydrocarbons (e.g. diesel, petrol, etc.), or other means.
- The prepared surface has not deteriorated since the acceptance inspection and is still acceptable immediately prior to placement of the GCDC.
- Any geomembrane liner immediately underlying the GCDC is clean and free of debris.
- All personnel working on the geomembrane and GCDC shall not smoke, wear damaging shoes, or engage in any activities which could damage the geomembrane or GCDC.
- The method used to unroll the panels must not cause crimps in the GCDC, and must not damage the underlying geomembrane.
- The method used to place the panels shall minimise wrinkles (especially differential wrinkles between adjacent panels).
- Adequate temporary loading and/or anchoring (e.g., sand bags, tyres), which will not damage the GCDC, must be placed to prevent uplift by wind.

Each geomembrane and GCDC layer shall be inspected for damage after placement, prior to seaming. Damaged areas shall be marked, removed and repaired in accordance with the specifications. The locations of repaired sections shall be recorded in the quality control documentation.

Rolls shall be laid flat on the installed underlying geomembrane liner without folds or wrinkles, with a standard overlap or seam as specified by the manufacturer in both longitudinal and transverse directions. The orientation of the placed GCDC is to such that the cusps (dimples) are facing upwards, unless otherwise approved by the engineer.

No vehicular traffic shall be allowed on the installed lining and walking on the liners must be kept to an absolute minimum. Acceptable installation therefore may be accomplished such that the GCDC is unrolled in front of

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backward moving equipment. If the installation equipment causes rutting of the sub-grade, the sub-grade must be restored to its original accepted condition before placement continues.

Care must be taken to minimise the extent to which the GCDC is dragged across the underlying geomembrane liner in order to avoid damage to the GCDC and the underlying geomembrane, and to prevent the formation of folds in the underlying liner.

PS GCDC 5.2: Anchorage

The outer edge of the GCDC is to be anchored in the same anchor trench (400mm x 400mm minimum) at the top of the slope, together with the other components of the lining system, as shown on the drawings. The front edge of the trench is to be rounded, so as to prevent stress concentrations on the GCDC.

The GCDC is to be placed in the trench such that it covers the entire trench floor, but does not extend up the rear trench wall.

The anchorage trench is to be backfilled and compacted in layers not exceeding 150mm thick, with selected material from the trench excavation.

PS GCDC 5.3: Seaming

In general, field seams should be oriented parallel to the line of maximum slope. In corners and odd-shaped geometric locations, the number of seams should be minimised. No horizontal seams should be less than 1.5m from the toe of the slope or areas of potential stress concentrations, unless otherwise authorised. When full roll lengths do not extend past the toe of the slope, panel ends may be seamed provided the panel is cut at an angle greater than 45 degrees.

A seam numbering system compatible with the panel numbering system shall be established.

Seaming of field panels shall be carried out by means of overlapping the two adjoining sheets of GCDC by at least 50 mm and interlocking the cusps of the two sheets into one another. If deemed necessary by site conditions, the seams can shall then be stitch-welded at 500 mm centres by means of a heat extrusion welding process.

The extrusion welding apparatus shall be equipped with gauges giving the temperature at the nozzle and extruder barrel.

Prior to seaming, the seam area is to be clean and free of moisture, dust, dirt, debris of any kind, and foreign material. Seaming shall not take place in excessively high temperatures or at ambient temperatures below 20C. In all cases, the GCDC sheets shall be dry and protected from the wind.

Trial seams shall be made on fragment pieces of GCDC to verify that seaming conditions are adequate. Such trial seams shall be made at the beginning of each seaming period for each seaming apparatus used. Trial seams shall be made under the same conditions as the actual seams. The trial seam shall be approximately 1m long by 300mm wide, with the seam centred lengthwise.

PS GCDC 5.4: Installation around penetrations and structures

The GCDC shall be cut away to fit neatly around penetrations and structures through the liner system. No welding or sealing of the GCDC is required around penetrations and structures through the lining system.

PS GCDC 5.4: Damage repair

Any repairs shall be in accordance with the manufacturer's instructions and subject to approval by the engineer.

PS GCDC 6: Tolerances

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The tolerances required in the supporting specifications shall apply.

PS GCDC 7: Testing

The Contractor shall supply with his tender, a Construction Quality Assurance/Control Plan which clearly indicates documentation ensuring compliance with the necessary material specifications, and control points requiring quality control checking during construction/installation.

PS GCDC 8: Measurement and Payment

PS GCDC 8.1: Geosynthetic cusped drainage core

(a) Description of type

- (i) (Position and area indicated).....Unit: m<sup>2</sup>  
(ii) Etc for other positions and areas

(b) Etc for other types

Separate items will be scheduled for different structures or areas to be lined.

The unit of measurement will be square metres of lined surface. No additional area shall be measured as overlaps and/or wastage. Similarly, no additional payment will be made for cutting GCDC around penetrations and structures.

This item includes full compensation for procuring, furnishing and placing or application of materials including cutting and wasting and bending up against structures over filler blocks, and preparing ends for fixing to structures and for all labour incidentals required for the installation or application of the geosynthetic cusped drainage core, complete as per manufacturer's specifications.

PS GCDC 8.2: Extra over PS GD 8.1 for cutting and trimming geosynthetic cusped drainage core around pipes, openings etc. not exceeding 300mm diameter .....Unit: No

This item shall be an extra over rate for item PS MWD8.1 and includes full compensation for the extra work involved to cut and trim the geosynthetic cusped drainage core around pipes and openings etc.

PS GCDC 8.3: Anchorage of geosynthetic cusped drainage core according to detail in anchor trench together with other liner components (excavation and backfilling measured elsewhere .....Unit: m

This item includes the cost of all plant, labour and materials required for the anchorage of the geosynthetic cusped drainage core in an earth trench as detailed on the contract drawings.

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## **PS GM: GEOMEMBRANE LINERS**

### **Content**

PS GM 1 Scope  
PS GM 2 Supporting Specifications  
PS GM 3 Materials and Manufacturing  
PS GM 4 Geomembrane Manufacturing, Storage and Transportation  
PS GM 5 Construction  
PS GM 6 Tolerances  
PS GM 7 Testing  
PS GM 8 Measurement and Payment

### **Introduction**

This Specification for the supply and installation of the geomembrane liners is based on the SANS 10409 Code of Practice for the Design, Selection and Installation of Geomembranes.

### **PS GM 1: Scope**

This specification covers the requirements for furnishing materials, equipment and services necessary and incidental to complete high-density polyethylene (HDPE) geomembrane installations, as part of the composite lining system for the Sanitary Landfill and Leachate Pond.

### **PS GM 2: Supporting Specifications**

The publications below form part of this specification to the extent referenced. Where a particular publication is referred to, that publication shall, unless otherwise stated, be the edition in effect 30 (thirty) days prior to the date of issue of this specification. Any contradictions between publications shall be submitted to the Engineer for decision.

#### **Project Specification**

- a) SANS 1526 (2003) – Thermoplastics sheeting for use as a geomembrane
- b) SANS 10409 (2005) – Design, selection and installation of geomembranes
- c) GRI Standard GM13 – Standard Specification for Test Properties, Test Frequencies and Recommended
- d) Warranties for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
- e) GRI Standard GM17 – Test Methods, Test Properties and Testing Frequency for Linear Low Density Polyethylene (LLDPE) Smooth and Textured Geomembranes
- f) GRI Standard GM19 - Standard Specification for Seam Strength and Related properties of Thermally Bonded Polyolefin Geomembranes
- g) ISO 472 Plastics – Vocabulary.
- h) American Society for Testing and Materials (ASTM)
  - D638 Standard Test Method for Tensile Properties of Plastics
  - D696 Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between –30 °C and –30 °C with a Vitreous Silica Dilatometer.
  - D746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
  - D792 Standard Test Method for Specific Gravity and Density of Plastics by Displacement
  - D1004 Test Method for Initial Tear Resistance of Plastic Film and Sheeting
  - D1204 Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheeting or Film at Elevated Temperature
  - D1603 Test Method for Carbon Black in Olefin Plastics
  - D3895 Standard Test Method for Determining the Minimum Oxidative Induction Time of Geomembranes
  - D4437 Standard Practice for Determining the Integrity of Field Seams Used in joining Flexible Polymeric Sheet Geomembranes
  - D4439 Standard Terminology for Geosynthetics.

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- D4833-88(1996)e1 Standard Test Method for Index Puncture Resistance of Geotextiles, Geomembranes and Related Products
- D5199-98 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
- D5397 Standard Test Method for Single Point Notched Load Test for Geomembranes
- D5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
- D5617 Standard Test Method for Multi-Axial Tension Test for Geosynthetics.
- D5886-95 Standard Guide for Selection of Test Methods to Determine Rate of Fluid Permeation Through Geomembranes for Specific Applications
- E831 Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis.

PS GM 2.1 Application

This specification contains clauses that are generally applicable to the manufacture, supply and installation of geomembrane liners.

PS GM 2.2 Definitions

For the purposes of this specification, the definitions given in the Contract and the following definitions shall apply:

**"High Density Polyethylene Geomembrane (HDPE)"** is a planar, relatively impermeable, polymeric sheet used in contact with soil/rock and/or any other geotechnical material in civil engineering applications, which is manufactured from a polyethylene resin with a density of less than 0.940 g/cm<sup>3</sup>, but greater than 0.930 g/cm<sup>3</sup>.

**"Lot"** is a quantity of resin, usually the capacity of one railcar used in the manufacture of geomembrane that shall be identified on the geomembrane roll.

**"Master Seamer"** is the person in the Contractor's organisation who is responsible for all seaming operations, and shall possess the minimum qualifications required in the Project Specifications. The Master Seamer may also be the Superintendent as defined in the Project Specification.

**"Minimum Average Roll Value (MARV)"** is the property value calculated as Typical Roll Value minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed the Minimum Average Roll Value.

**"Panel"** is an unbroken unit of geomembrane that is seamed on the Site.

**"Prepared Subgrade"** is the layer of in situ material that underlies the geosynthetic liner.

**"Typical Roll Value (TRV)"** is the property value calculated as the mean, or average, obtained from test data for one roll.

**"Welding Technician"** is a person in the Contractor's organization who performs geomembrane welding operations, and shall possess the minimum qualifications required in the Project Specification.

**"Manufacturing Quality Control (MQC)"** is a planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory-originated. It is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications

**"Manufacturing Quality Assurance (MQA)"**, is a planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. It includes inspections of the manufacturing facility, verifications, audits and evaluations of the raw materials (resins and additives) and geosynthetic products, to assess the quality of the manufactured materials. MQA

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refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project

**PS GM 3:** Materials

**PS GM 3.1:** Primary and Secondary Liners

The primary and secondary liner material shall comply with the requirements of SANS Specification 1526 for Geomembranes. It shall consist of a Pure High Density Polyethylene (HDPE) incorporating an evenly dispersed carbon black content as well as time proven Ultra Violet stabilisers and anti-oxidants. Reprocessed or reground materials shall not be used.

The primary liner geomembrane is to have a nominal thickness of 1.5 mm as specified.

The secondary liner geomembrane is to have a nominal thickness of 1.0 mm as specified.

The HDPE material supplied for the primary and secondary geomembrane liners shall comply with the minimum property specifications as contained in GRI-GM13 Table 1(b) "High Density Polyethylene (HDPE) Geomembrane (Smooth)" (SI Metric Units).

**PS GM 3.2:** Interface Liner

The interface liner material shall comply with the requirements of SANS Specification 1526 for Geomembranes. It shall consist of a Pure High Density Polyethylene (HDPE) incorporating an evenly dispersed carbon black content as well as time proven Ultra Violet stabilisers and anti-oxidants. Reprocessed or reground materials shall not be used.

The interface liner geomembrane is to have a nominal thickness of 2.0 mm as specified.

The HDPE material supplied for the interface liner shall comply with the minimum property specifications as contained in GRI-GM13 Table 1(b) "High Density Polyethylene (HDPE) Geomembrane (Smooth)" (SI Metric Units).

**PS GM 3.3:** Materials general

The geomembrane liners are to be supplied to site in panels no less than 6,5 m wide to minimize the number of site welds required. If necessary, factory controlled welding is to be carried out to attain the required minimum width.

The purpose of the liners is to create a barrier against seepage of leachate from the base of the landfill. The physical and chemical characteristics of the respective geomembranes and their jointing systems must be such that the integrity of the geomembranes is maintained during the construction of the landfill and shall have at least a hundred year life period. As such the geomembranes shall be resistant to degradation as a result of the temperature and chemical characteristics of stored product, sunlight, ultra violet rays, ozone, airborne pollution and weathering.

**PS GM 4:** Geomembranes Manufacturing, Transportation and Storage

**PS GM 4.1:** Qualification of Geomembrane Manufacturer

Details of the Manufacturer shall be provided by the Geosynthetic Materials (GSM) Installer in the Data Sheets forming part of this Tender.

The Manufacturer shall be able to provide sufficient production capacity and qualified personnel to meet the demands of this project.

The Manufacturer shall be approved by the Engineer and the Employer and the following information is to be submitted:

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1. Corporate background and information
2. Manufacturing capabilities:
  - Information on plant size, equipment, number of shifts per day, capacity per shift, quality control manual for manufacturing
  - List of material properties, including certified test results
3. A list of at least 10 completed projects totaling a minimum area of 2,000,000 m<sup>2</sup> for which the Manufacturer has manufactured geomembrane materials from the same type as that proposed to be used for this Contract. For each facility, the following information will be provided:
  - Purpose of installation, its location and start/finish dates
  - Name of facility owner, project manager and engineer
  - Type, thickness and surface area of the installed geomembrane
4. Manufacturing Quality Control manuals and related documentation

PS GM 4.2: Geomembrane Plant Audit

PS GM 4.2.1 Scope

The Engineer may perform an audit of the manufacturing and quality control procedures used by the Manufacturer, specifically for the production of the geomembranes to be used for installation at the Employer's facility. The Manufacturer shall give the Engineer at least one month's notice of the start of production of geomembranes for this project. QC tests shall be performed as the geomembranes are manufactured.

PS GM 4.2.2 Quality Control

The manufacturer shall make available to the Employer and Engineer, Manufacturing Quality Control manuals, which outline all quality procedures, to be implemented for the manufacture of the geomembranes.

The Manufacturer shall provide valid calibration certificates for laboratory testing equipment. The Engineer shall verify that, during select runs of material, all MQC procedures are performed.

PS GM 4.2.3 Manufacturing Process

In general, the Manufacturer shall provide access for the Engineer to all equipment used to manufacture the geomembranes. This does not include divulging trade secrets, formulations and procedures that are not commonly known as basic manufacturing processes.

The Engineer shall monitor production and testing of geomembrane material allocated for this project. If material for this project has already been manufactured, the Engineer shall monitor production of the same type of geomembrane on the same production line to verify that manufacturing controls are in place. Additional tests by one independent laboratory are also required before the material will be approved. The Engineer shall review the QC certificates and notify the Manufacturer in writing which geomembrane rolls are approved for shipping. The Engineer shall be allowed to monitor the loading of the geomembranes for shipping.

Where material, which has already been manufactured and has been delivered to storage in Liberia or elsewhere, the Engineer shall be furnished with the test results from an independent laboratory and the QC certificates and will notify the Manufacturer in writing which geomembrane rolls are approved for shipping from storage.

The Contractor/Installer shall obtain approval from the Engineer before the geomembrane material is loaded for shipping.

Polyethylene geomembrane shall be of the type specified on the Drawings, and shall be high-density polyethylene.

PS GM 4.3 Manufacturing of Geomembranes

PS GM 4.3.1 Resin Properties

The base resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane, and supplied by the same manufacturer. The base resin, prior to the addition of carbon black, shall conform to the following requirements:

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**Table 4.3.1: Compounded HDPE Resin Properties**

Property	ASTM Test Method	Value	MQ Test Frequency
Density, range	D1505	0,932 – 0,940 g/cm <sup>3</sup>	1 per Lot
Melt Flow Index <sup>1</sup> , max.	D1238	1,0 g/10 minutes	1 per Lot
Oxidative Induction Time <sup>2</sup> , min.	D3895	100 minutes	
<sup>1</sup> Using 2,16 kg at 190 <sup>o</sup> C.			
<sup>2</sup> At 200 <sup>o</sup> C in oxygen at 1 atmosphere.			

Internal Quality Assurance testing will be carried out by the geomembrane Manufacturer to demonstrate that the incoming resin meets this specification. The resin shall be virgin material with no more than 10 percent rework. If rework is used, it shall be of the same formulation as the parent material. No post-consumer resin of any type shall be added to the formulation.

PS GM 4.3.2 Geomembrane Properties

**The geomembrane shall be of high quality formulation polyethylene material, resistant to ultraviolet rays, manufactured of new, first-quality products, containing no plasticizers, fillers or extenders, and designed and manufactured specifically for the purpose of liquid containment in hydraulic structures.** A maximum of 3 percent total additives consisting of carbon black, anti-oxidants and heat stabilizers, with a maximum of 1 percent of additives other than carbon black, shall be permitted in the geomembrane.

The finished material shall be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter, and nicks and cuts on roll edges. The geomembrane material shall be supplied in rolls having a minimum width of 6,7 metres and shall have no factory seams.

The material shall be manufactured with or without surface texture as required on the Drawings, and shall conform to the following additional requirements:

Smooth geomembrane shall have no texture applied to its surfaces. The material provided as smooth HDPE geomembrane shall conform to the following requirements:

**Table 4.3.2: Material Specification for Smooth HDPE Geomembrane**

Property	ASTM Test Method	Value		MQ Test Frequency
<b>Nominal Geomembrane Thickness</b>		<b>1,5 mm</b>	<b>2,0 mm</b>	
Thickness:				
Minimum (average of all of 10 values)	D5199	1,5 mm	2,0 mm	Each Roll
Minimum (individual of any of 10 values)	D5199	1,35 mm	1,8 mm	Each Roll
Density, min.	D1505	0,94 g/cm <sup>3</sup>	0,94 g/cm <sup>3</sup>	90000 kg
Tensile Properties in each direction(1) (min ave.)	D6693 Type IV			
Yield Strength,		22 N/mm	29 N/mm	
Break Strength, min.		40 N/mm	53 N/mm	9000 kg
Yield Elongation, min.		12 %	12 %	
33 mm gauge length				
Break Elongation, min.		700 %	700 %	
50 mm gauge length				
Tear Resistance, min.	D1004	187 N	249 N	20000 kg
Puncture Resistance, min.	D4833	480 N	640 N	20000 kg
Environmental Stress Crack Resistance(2) (Constant Load), min.	D5397 Appendix	300 hours	300 hours	90000 kg

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**Table 4.3.2: Material Specification for Smooth HDPE Geomembrane**

Property	ASTM Test Method	Value		MQ Test Frequency
		1,5 mm	2,0 mm	
Nominal Geomembrane Thickness		1,5 mm	2,0 mm	90000 kg
rittleness Temperature by Impact (Condition B), max.	D746	- 77° C	- 77° C	90000 kg
Dimensional Stability <sup>2</sup> , max. change in each direction	D1204	<2 %	<2 %	90000 kg
Carbon Black Content, range	D1603(3)	2.0 – 3.0 %	2.0 – 3.0 %	9000 kg
Carbon Black Dispersion	D5596	See Note 4	See Note 4	20000 kg
Oxidative Induction Time (OIT) (min. ave.) (5) (a) Standard OIT — or — (b) High Pressure OIT	D 3895 D 5885	100 min. 400 min.	100 min. 400 min.	90,000 kg
Oven Aging at 85°C (5), (6) (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895 D 5885	55% 80%	55% 80%	per each formulation
UV Resistance (7) (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs (9)	D 3895 D 5885	N.R. (8) 50%	N.R. (8) 50%	per each formulation
<p>(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction Yield elongation is calculated using a gage length of 33 mm Break elongation is calculated using a gage length of 50 mm (2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing. (3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established. (4) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3 (5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane. (6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response. (7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C. (8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples. (9) UV resistance is based on percent retained value regardless of the original HP-OIT value.</p>				

Smooth geomembrane shall have good appearance qualities, and shall be free from such defects that would affect the specified properties.

#### PS GM 4.3.3 Submittals

The geomembrane manufacturer shall issue Quality Control submissions to the Engineer and the QA Officer for each delivery of material.

Prior to the shipment of any geomembrane, the Manufacturer will provide the Engineer with the following:

- A certified properties sheet including, at a minimum, all specified properties, and test methods indicated in the specifications.
- The internal MQC sampling procedures, frequencies of testing, and results of testing of material supplied to the project.

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The QA Officer will verify that:

- The property values certified by the Manufacturer are properly documented, the test methods used are acceptable and the geomembrane meets the Project Specifications.

Geomembrane Manufacturer Tracking List – Cross-referencing list delineating the corresponding resin used in the production of the rolls delivered.

Manufacturing Quality Control Data – The manufacturing quality control test data indicating the actual test values.

Physical Properties Sheet – The material specification for the geomembrane supplied in accordance with this specification and that no plasticizers, fillers, or extenders were added during the manufacture of the resin, geomembrane and extrudate rods and beads.

Letter of Certification – The letter indicating that the material is in conformance with the physical properties specified.

#### PS GM 4.3.4 Testing

The geomembrane material shall be tested by the manufacturer for compliance with the specifications listed in Tables 4.3.1 and 4.3.2 by the test methods and frequencies indicated. The costs of these tests are to be included for in the tendered price.

Conformance Testing may, at the discretion of the Engineer, be carried out by an independent laboratory (MQA laboratory). Conformance testing is not an opportunity to reproduce the QC testing program. It is a check to provide confirmation that satisfactory material is delivered to the site. The testing frequency shall be at the discretion of the Engineer, but the frequency as indicated in Tables 4.3.1 and 4.3.2 can be used as a guideline. The name and address of the laboratory shall be approved by the Engineer. The Engineer has a right to reject any roll or production batch if the samples do not pass the conformance testing.

Conformance Testing will be performed **before** material is shipped from the Manufacturer's plant so that it may be used immediately on arrival at the site.

#### PS GM 4.3.5 In-Plant Conformance Testing

The purpose of in-plant Material Conformance Test Sampling is to verify that geomembrane material which is designated for the Owner's project is confirmed as meeting the project specifications prior to shipment to the site. Thus barring a transportation accident, the geomembrane can be installed immediately it arrives on site.

The Manufacturer will make available all necessary personnel and equipment to assist the QA Officer in retrieving conformance samples of the geomembrane material.

The QA Officer shall send to the MQA Laboratory conformance samples for testing. The frequency of sampling shall be at the discretion of the QA Officer but shall typically be between 10 000 m<sup>2</sup> and 25 000 m<sup>2</sup> of geomembrane. No material shall be shipped to the site until conformance test results are obtained.

The QA Officer shall report any non-conformance of sampling procedures as outlined in Section 4.3.3 to the Engineer.

#### PS GM 4.3.6 On-site conformance testing

If in-plant conformance testing is not possible, upon delivery of the rolls of geomembranes to the site, the QA Officer will ensure that samples are removed at the frequency specified in the Project Specifications and forwarded to the MQA Laboratory for testing to ensure conformance to both the Project Specifications and the Manufacturer's list of guaranteed properties.

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PS GM 4.3.7 Sampling

Samples will be taken across the entire width of the roll and will not include the outer wrap of the roll. Unless otherwise specified, samples will be 500 mm long by the roll width. Specimens for testing will be taken across the full width of the sample.

If more than one resin type is used, each resin type shall be sampled at the same frequencies and tested.

If roll numbers are very different and non-sequential, consideration should be given to testing each block of roll numbers at the same frequency.

PS GM 4.3.8 Test Results

The QA Officer will examine all results from laboratory conformance testing and will report any non-conformance to the Engineer.

The following procedure will apply whenever a sample fails a conformance test that is conducted by the MQA Laboratory:

- The Supplier will replace the roll of geomembrane that is in non-conformance with the specifications with a roll that meets specifications.
- The QA Officer will remove conformance samples for testing by the MQA Laboratory from the next higher and next lower numbered rolls. These two samples must both conform to specifications. If either of these samples fails, testing shall continue until the defective rolls are isolated. The Supplier, at no expense to the Owner, will replace these rolls. This additional conformance testing will be at the expense of the Supplier.
- The QA Officer will document actions taken in conjunction with conformance test failures.

PS GM 4.3.9 Packaging and Identification

All geomembrane rolls shall be packaged in opaque moisture resistant plastic sleeves. The roll cores shall be sufficiently strong to resist collapse during transit and handling. The Engineer has the right to reject any roll if the core has collapsed or if the roll is damaged in any other way.

Before shipment, the manufacturer shall label each roll, both on the geomembrane roll and on the surface of the plastic protective sleeve. Labels shall be resistant to fading and moisture degradation to ensure legibility at the time of installation. At a minimum the roll labels shall identify the following:

- Product Name and Grade
- Length and Width of roll
- Total weight of roll
- Production Lot number and Individual roll number

PS GM 5: Transportation, Handling and Storage of Geomembrane Liners

PS GM 5.1 Transportation and handling of materials

The installer shall contact the supplier before shipment to determine if the unloading methods and equipment differs from that specified below. Significant deviations from these procedures shall be pre-approved by the Engineer in writing.

Geomembranes must be supported during the handling to ensure worker safety and to prevent damage to the product. Under no circumstances may the rolls be dragged, lifted from one end, lifted with only the forks of a lift truck or dropped on the ground from the delivery vehicle.

The QA officer shall verify that proper handling equipment exists which does not pose any danger to installation personnel or risk of damage or deformation to the liner material itself. Suitable handling equipment is described below:

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**Spreader Bar Assembly** – A spreader bar assembly shall include a core pipe or bar and a spreader bar beam. The core pipe shall be used to uniformly support the roll when inserted through the geomembrane core while the spreader bar beam will prevent chains or straps from chafing the roll edges.

**Carpet Spike** – A carpet spike is a rigid pipe or rod with one end directly connected to a forklift or other handling equipment and the other end rounded off to allow easy insertion into roll material cores. If a carpet spike is used, it must be at least 3.0m long and inserted to its full length into the roll core to prevent excessive bending of the roll when lifted.

**Roller Cradles** – Roller cradles consist of two large diameter rollers spaced approximately 75 mm apart, which both support the geomembrane roll and allow it to unroll freely. The use of roller cradles will be permitted if the rollers support the entire width of the geomembrane roll.

**Straps** – Straps may be used to support the ends of spreader bars but are not recommended as the primary support mechanism. As straps may damage the geomembrane where wrapped around the roll and generally do not provide sufficient uniform support to prevent roll bending or deformation, great care must be exercised when this option is used.

#### PS GM 5.2 Inspection upon delivery

Each roll shall be visually inspected when unloaded to determine if any packaging or material has been damaged during transit. Possible product conditions and actions are listed below:

- Rolls, including the roll cores, exhibiting damage shall be marked and set aside for closer examination during employment. Minor rips or tears in the plastic packaging shall be repaired with moisture resistant tape before being placed in storage to prevent moisture damage.
- The presence of free-flowing water within any roll packaging shall require that the roll is set aside for further examination to ascertain the extent of any damage.
- Geomembrane rolls delivered to the project site shall be those indicated on geomembrane manufacturing quality control certificates.
- Repairs to damaged geomembrane rolls shall be performed in accordance with Item 7.4 of this specification.

The Engineer reserves the right to reject any roll at any stage prior to installation should it exhibit any of the above damages or non-conformance.

#### PS GM 5.3 Storage

A designated storage area shall be established in a location such that on-site transportation and handling are minimised. The storage area should be protected from theft, vandalism, passage of vehicles, and be adjacent to the area to be lined. The geomembrane rolls shall be stored lying flat and continuously supported.

#### PS GM 5.4 Overview of Quality Assurance Submissions

##### PS GM 5.4.1 Manufacturing Quality Assurance Documentation

Geomembrane Manufacturing Quality Assurance (MQA) sampling and testing for compliance with this specification shall be co-ordinated by the Quality Assurance (QA) officer as necessary to support the Manufacturing Quality Control (MQC) data.

##### PS GM 5.4.2 Information required at tender

The following shall be submitted with the Tender:

- Statement of experience from the proposed geosynthetic membrane manufacturer/supplier.
- Statement of experience from the proposed geosynthetic membrane Installer.
- Statement of the details of the supplier/manufacturer of the geosynthetic membranes.
- This is to be submitted during the tender evaluation period on request from the engineer and no deviation from this will be allowed before the completion of the contract, special permission must be obtained in writing from the Engineer to obtain the geosynthetic membranes from another supplier. However, no change of unit rate of supply or installation will be allowed. The material supply costs and **contractor's** markup is also to be supplied.
- Geomembrane material specification sheet

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PSGM 5.4.3 Submissions required before shipment

Prior to shipment, the Manufacturer will furnish the QA officer with Quality Control certificates covering each roll of geomembrane and welding rods provided. (NOTE: Tests do not have to be done on each roll, they simply need to be done according to the frequency, defined in Item 4.3. The Quality Control certificate will be signed by a responsible party employed by the Manufacturer, preferably the QC Laboratory Manager.

The Quality Control certificates will include:

- Resin manufacturer, resin type, resin lot number and geomembrane roll numbers.
- Results of QC tests. At a minimum, results will be given for thickness, specific gravity/density, uniaxial tensile strength and elongation at yield and break, single point stress rupture time, and carbon black content and dispersion, evaluated in accordance with the methods indicated in the specifications or equivalent methods previously approved by the Project Manager and QA officer. No material will be installed until complete QC test data have been approved by the Project Manager and CQAO. No material will be installed until complete QC data have been provided.

The QA officer will:

- Verify that the Quality Control certificates have been provided at the specified frequency for all rolls and that each certificate identifies the rolls and resin related to it:
- Review the QC certificates and verify that the certified roll properties meet the Manufacturer's and Project Specification

PS GM 5.4.4 Extrudate Rods and Beads

The extrudate rods and beads shall be manufactured from the same resin type as the geomembrane, and additives shall be thoroughly dispersed throughout the material. Details of this must be provided in writing prior to the start of construction. The material shall be free of contamination by moisture and foreign matter.

PS GM 5.4.5 Materials Warranty

The Contractor shall request, and the geomembrane manufacturer shall provide a warrant of the quality of the geomembrane material, and that the material will not fail due to ultraviolet degradation for a minimum period of 10 (ten) years from date of acceptance of installation. The warranty shall cover the cost of material, labour and equipment to replace the failed geomembrane.

PS GM 6: GEOMEMBRANE INSTALLATION

The area to be lined must be free of all protrusions, stones, roots, vegetation and other materials which may be detrimental to the performance of the liner. On the surface to be lined, a maximum particle size of 3 mm diameter is permissible.

The final surface layer shall be left smooth and dense and finished levels shall be correct to within + 30 mm as measured under a 3 m long straight edge.

The surface must be inspected by the lining Contractor before the liner is installed. The liner must be installed with due consideration to ensure that the geomembrane is in no way damaged or penetrated during construction. Construction joints in the lining must be sealed by way of a continuous heat weld using an extrusion/fusion process or an Electric Double Wedge System, both of which produce a totally homogeneous seam.

PS GM 6.1 Equipment

PS GM 6.1.1 General

The Contractor shall provide and maintain all equipment that is necessary and suitable for handling, installing, and testing geosynthetic membranes under the conditions found on the Site.

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PS GM 6.1.2 Geomembrane Welding Equipment

The Contractor shall maintain on the Site, in fully operable condition, sufficient spare geomembrane welding equipment and generators so that the seaming operations are not adversely affected by equipment failures. As a minimum one spare welder in working condition for every five or less production welders, and one spare generator in working condition for every five or less production generators, shall be provided.

PS GM 6.1.3 Fusion Welding

The fusion welding equipment used shall be an automated, self-propelled device capable of operating unassisted on the slopes to be covered with geomembrane and equipped with a seaming speed controller and an electronic controller capable of continuously displaying, monitoring and controlling the temperature in the zone of contact where the machine is actually fusing the geomembrane material. In addition, the fusion welding equipment shall be capable of producing a seam with an enclosed air space.

PS GM 6.1.4 Extrusion Welding

The extrusion welding equipment used shall be equipped with two temperature gauges, each capable of continuously displaying the temperature, one at the pre-heat and the other at the extrudate.

PS GM 6.1.5 Heat Bonding

The temperature of the hot air at the heat nozzle of the heat bonding apparatus shall be capable of being controlled such that the geomembrane is not damaged.

PS GM 6.1.6 Generators

Power sources capable of providing constant voltage under the combined line load shall be used.

PS GM 6.2 Safety

The Contractor shall be solely and completely responsible, until completion of the Work, for the safety of its employees, the employees of others, and the public while they are in the Contractor's working areas. The Contractor is responsible to employ the proper systems and techniques and shall be solely responsible for the safety, adequacy, and cost of the methods employed.

The Contractor shall be aware of risks inherent in working with geomembrane, such as slipping, and shall provide suitable access by means of rope ladders and/or non-slip walking surfaces. Precautions shall be taken to prevent heat stroke and the effects of heat radiation from working on the geomembrane surface.

PS GM 6.3 Panel Layout

Prior to commencing geomembrane deployment the Contractor shall prepare and submit to the Engineer for approval a proposed panel layout drawing for each type of geomembrane and each layer showing the proposed deployment pattern and sequence, and general location of field seams. No deployment of geomembrane shall commence until the panel layout has been approved by the Engineer.

In preparing the panel layout, the Contractor shall take into account the construction schedule, access restrictions and the following limitations placed on seam locations:

- To the maximum extent possible, field seams shall be parallel to the slope
- The number of transverse field seams on slopes steeper than 6H:1V shall be minimized, and in this case the location of such seams shall be approved by the Engineer
- A minimum of 1,0 metre shall be provided from the toe of any slope steeper than 6H:1V before providing any transverse seam
- The field seams at inside and outside corners, odd-shaped geometric configurations, seam convergences, and small panels shall be avoided

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Each panel, seam, and penetration shall be given a simple and logical identification code consistent with the panel layout drawing. The panel layout drawing shall be updated from time to time to reflect the actual deployment configuration and shall show the locations of destructive tests.

On completion of the installation the Lining Contractor/Installer shall prepare and submit to the Engineer as-built drawings to scale for each type of geomembrane and each layer, showing the final panel layout and test locations.

PS GM 6.4     Substrata Acceptance

PS GM 6.4.1   Prepared Subgrade Acceptance

Prior to deployment of geomembrane over the prepared subgrade, the Contractor shall inspect, with the earthworks contractor, QC Contractor and Engineer, all surfaces on and trenches in which the geomembrane is to be placed. The Contractor shall certify in writing that the prepared subgrade is acceptable for the installation of the geomembrane. Surfaces not in compliance with the Specifications shall be rectified by the earthworks contractor and be subjected to inspection and acceptance before geomembrane is deployed. The responsibility for maintenance of the accepted areas remains the responsibility of the Earthworks Contractor.

PS GM 6.4.2   In-Place Geosynthetics Surface Acceptance

Prior to deployment of geomembrane over in-place geosynthetics, the Contractor shall inspect, with the QC Contractor and Engineer, all in-place geosynthetics surfaces on and trenches in which the geomembrane is to be placed. The surface shall be clean and free of debris, and the in-place geosynthetic material shall not have deteriorated since it was first deployed. The Contractor shall certify in writing that the in-place geosynthetics surface is acceptable for the installation of the geomembrane. Surfaces not in compliance with the Specifications shall be rectified by the Contractor and be subjected to inspection and acceptance before geomembrane is deployed. The responsibility for maintenance of the accepted areas is described in the Project Specification.

PS GM 6.5     Deployment

The geomembrane shall be installed on the approved areas shown on the Drawings and according to the approved panel layout, or as directed by the Engineer, using methods and procedures that ensure a minimum of handling and to minimize the formation of wrinkles, especially differential wrinkles between adjacent panels.

Geomembrane deployment shall only proceed when ambient air temperatures measured are between 4 °C and 38 °C, unless approved by the Engineer.

The method used to unroll the geomembrane shall not cause scratches or crimps in the geomembrane and shall not damage the prepared subgrade or in-place geosynthetics. The geomembrane shall not be dragged over gravel, stones, debris or other material that could cause it damage. During deployment, the geomembrane shall be visually inspected by the CQC Contractor. Damaged, faulty or suspect areas shall be marked for testing and/or repair.

The geomembrane shall be placed one panel at a time in a relaxed condition with the required overlap so that it is in intimate contact with the underlying subgrade at all locations and free of tension or stress upon completion of the installation. All necessary precautions, including installing extra material, shall be taken to avoid bridging of geomembrane. Cutting and trimming of geomembrane placed over other geomembranes shall be undertaken with hooked-blade knives or other approved cutters. Special care shall be taken to protect other geosynthetic materials from damage that could be caused when cutting.

No equipment or procedures shall be used that could damage the geomembrane or excessive rutting of the prepared subgrade. Any equipment that has the potential to leak hydrocarbons shall be repaired, modified or removed from the Site. Areas of heavy foot traffic, under portable generators, and locations where portable welding machines, fuel cans, or tools are placed on the geomembrane, shall be protected with geotextile or

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geomembrane scraps. Personnel shall not engage in activities, e.g., smoking, or wear shoes that could damage the geomembrane. Vehicles shall not be permitted on the geomembrane.

All panels, whether welded or not, shall be securely ballasted and anchored at all times to prevent any wind uplift, movement, or slipping, using sandbags or other items that will not damage the geomembrane. The ballast material shall be provided by the Contractor.

Only the amount of geomembrane that can be seamed up by the end of the work day shall be deployed, unless otherwise approved by the Engineer, and the amount of geomembrane deployed without quality control and repairs being completed shall not exceed 20 000 m<sup>2</sup>.

PS GM 6.6 Seaming

PS GM 6.6.1 General

Geomembrane seams shall be created using thermal methods. A Master Seamer shall be on the Site and supervising seaming operations at all times when seaming operations are in progress. No Welding Technicians or welding apparatus shall be allowed to perform field seaming operations until the technicians and equipment have successfully completed prequalification and trial seams called for in **Error! Reference source not found.** and **Error! Reference source not found.**, respectively.

PS GM 6.6.2 Welding Technician and Welding Apparatus Prequalification

When a Welding Technician arrives on the Site for the first time or after an absence from Site exceeding one month, he/she shall be prequalified in the presence of the QC Contractor by performing three consecutive passing trial welds made according to **Error! Reference source not found.** for each geomembrane type and thickness to be welded by the technician.

When a welding apparatus arrives on the Site for the first time, after repair, or after being removed from the Site, it shall be prequalified in the presence of the QC Contractor by performing three consecutive passing trial welds made according to **Error! Reference source not found.** for each geomembrane type and thickness to be welded by the apparatus.

A new or returning Welding Technician may be prequalified using an existing welding apparatus, and a new, repaired, or returning welding apparatus may be prequalified by a qualified Welding Technician.

A record shall be maintained of each geomembrane type and thickness for which each technician and apparatus has prequalified, and a technician or apparatus shall not be used for seaming operations for which it has not prequalified.

PS GM 6.6.3 Weather Restrictions

The Contractor shall take into account that rapid weather changes are possible at the Site, resulting in delays in production of field seams. Seaming shall only be undertaken under weather conditions allowing such work within the warranty limits imposed by the geomembrane manufacturer and which will not jeopardize the integrity of the geomembrane installation. Seaming shall not occur under adverse environmental conditions, including, but not limited to:

- Precipitation of any kind, including condensing fog
- Areas of ponded water
- Periods of excessive winds or dust
- Extreme heat or cold, unless trial and field seams are shown to produce acceptable and consistent results

PS GM 6.6.4 Preparation

Extreme care shall be taken by the Contractor in the preparation of the areas to be welded. The surface of the geomembrane in the area to be welded shall be cleaned and prepared, and shall be free of grease, moisture,

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dust, dirt, debris, and foreign material of any kind. Lint-free cloth rags shall be used for cleaning, and the Contractor shall supply at least one clean rag for every 30 metres of weld.

The area to be extrusion welded shall be roughened by grinding the surface no more than 30 minutes before welding. The roughened surface shall not extend beyond the extrudate bead and shall not remove more than 10 percent of the geomembrane thickness.

#### PS GM 6.6.5 Overlap

Adjacent panels shall be overlapped with the sufficient material required to perform the welding process, but in no case less than 125 mm for fusion welds and no case less than 75 mm for extrusion welds. To facilitate overlap control, the edge of deployed panels shall be marked at regular intervals with a mark showing the required overlap.

Overlaps shall be shingled in the direction of anticipated water flow in floors with a fall.

#### PS GM 6.6.6 Anchorage

The outer edges of the geomembrane liners are to be anchored in the same anchor trench (400mm x 400mm minimum) at the top of the slope, together with the other components of the lining system, as shown on the drawings. The front edge of the trench is to be rounded, so as to prevent stress concentrations on the geomembranes.

The geomembranes are to be placed in the trench such that they cover the entire trench floor, and extend up the rear trench wall.

The anchorage trench is to be backfilled and compacted in layers not exceeding 150mm thick, with selected material from the trench excavation. To minimise material bridging at the toe of the slope and the formation of wrinkles, backfilling of the anchor trench should be carried out during the cool of the morning or extended period of overcast skies. Care must be taken during backfilling of anchor trenches to prevent any damage to the geosynthetic lining components.

#### PS GM 6.6.7 Penetrations

Penetration details are given on the drawings for this contract and must be adhered to. Where factory welding of geomembranes to HDPE plates is required, such welding must be strictly controlled, the HDPE plate is to be pre-heated as required, and welds are to X-rayed to prove their effectiveness and approved by the Engineer before transportation to site.

#### PS GM 6.6.8 Placement on top of Geomembranes

Placement of subsequent geosynthetic layers, drainage media or soil on top of installed geomembrane liners shall not take place until all destructive and non-destructive testing has been completed and the geomembrane accepted.

Placement of material over the geomembrane shall be performed so as to minimise wrinkles. If a wrinkle forms, every effort shall be made to walk the wrinkle out prior to placement of material over the geomembrane. Minor folding over of wrinkles is acceptable, provided that an even transition occurs at the tail of the wrinkle. If excessive stress points are created at the tail of a wrinkle, the wrinkle should be cut out and repaired as specified.

Material placed on top of the geomembrane liner should be back-dumped on the liner, rather than being pushed across the liner, in an effort to reduce the formation of wrinkles.

#### PS GM 6.6.9 Fusion Welding

A fusion welding process shall generally be used for production seams, unless otherwise approved by the Engineer. A fragment strip of geomembrane shall be used beneath the seam area as required where the underling material is too cold, where moisture build-up between the sheets is expected, or to prevent the welding equipment from sticking to the prepared subgrade.

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#### PS GM 6.6.10 Extrusion Welding

An extrusion welding process shall generally be used primarily for repairs, detailing, capping, unless otherwise approved by the Engineer. The seam to be welded shall be temporarily spot heat bonded before extrusion welding. The temperature of the hot air at the heat nozzle of the heat bonding apparatus shall be controlled such that the geomembrane is not damaged. If non-destructive spark testing will be performed on the seam, a wire is embedded in the weld during the extrusion process.

When welding operations are interrupted, the extrusion welding apparatus shall be purged of heat-degraded extrudate before continuing welding. The restart end of any extrusion weld shall be tapered to a feather edge of not less than 100 mm in length.

#### PS GM 6.6.11 Markers

The QC Contractor shall provide sufficient indelible, legible markers (Mean Streak, or other approved) for its own use, and use by the Engineer. A colour convention shall be agreed by all parties.

#### PS GM 6.6.12 Seam Properties

All geomembrane seams shall conform to the following requirements:

**HDPE Geomembrane Seam Properties**

Property	ASTM Test Method	Units	Value	
			Fusion Welds	Extrusion Welds
Shear				
Break Strength <sup>1</sup> , min.	D4437	% of PM <sup>2</sup> break strength	100	100
Strain at Break <sup>1</sup> , min.	D4437	% of PM strain at break	50	50
Adhesion	NSF 54	-	FTB <sup>3</sup>	FTB
Peel <sup>4</sup>				
Break Strength <sup>1</sup> , min.	D4437	% of PM break strength	100	100
Incursion, max.	-	% of weld width	10	n/a
Adhesion	NSF 54	-	FTB	FTB
<sup>1</sup> Tests shall be performed at the same strain rate that was used when determining the parent material properties. <sup>2</sup> PM = parent material. <sup>3</sup> Break shall classify as film-tearing bond (FTB) as defined in NSF Standard 54 Annex A. <sup>4</sup> All failures shall be ductile.				

#### PS GM 6.6.13 Trial Seams

Before commencing production seaming, trial seams conforming to the requirements in **Error! Reference source not found.** shall be made, and approved by the Engineer, on the same subgrade, under the same operating and environmental conditions, using the same materials, overlap, and seaming techniques, by the same Welding Technician as will be used to fabricate field seams. Trial seams shall be made under the following conditions:

- To prequalify a Welding Technician upon arrival on the Site
- To prequalify a welding apparatus upon arrival on the Site
- Before commencing seaming operations at the start of a shift
- Before commencing seaming operations after the mid-shift break
- After every four hours of seaming operation
- When a different Welding Technician starts seaming
- When a welding apparatus is restarted after repair or adjustment
- After a welding apparatus is stopped for 30 minutes or more
- When there is a substantial change in environmental conditions
- At the sole discretion of the QC Contractor or the Engineer

Fusion weld trial seams shall be a minimum of 3,0 metres long by 300 mm wide after seaming, with the seam centred lengthwise. Extrusion weld trial seams shall be a minimum of 1,0 metre long by 300 mm wide after

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seaming, with the seam centred lengthwise. All trial seams shall be labelled by the Welding Technician, who shall record pertinent details relative to the weld, including:

- Welding Technician's initials
- Welding apparatus identification number
- Welding apparatus temperatures
- Ambient temperature measured 150 mm above the geomembrane
- Date and time welding of the seam commenced

The seam shall be allowed to cool naturally to ambient temperature before performing destructive testing described in 7.4.6. Failure of the trial seam to meet the specified requirements shall require the Master Seamer to establish the cause of the failure, take corrective action, and repeat the trial seam procedure. If the second trial seam fails, the Welding Technician and welding apparatus shall not be allowed to perform field seams until the deficiencies are corrected, and two consecutive passing trial seams are achieved.

The QC Contractor shall monitor the pass/fail ratio of trial seams with respect to geomembrane material, Welding Technician and welding apparatus, and the results shall be reported daily to the Engineer.

#### PS GM 6.6.14 Field Seams

The Welding Technician shall prepare the area to be welded, and continuously monitor the seaming operation and maintain the specified overlap. The welding apparatus temperature shall be monitored, and the information marked on the geomembrane periodically.

Seaming shall extend to the outside edge of geomembrane to be placed in trenches. No fish mouths shall be allowed within the seam area, and if fish mouths occur, the material shall be cut, overlapped, and extrusion welded. No seams shall be left unwelded and no openings in the geomembrane shall be left at the end of a shift, without approval from the Engineer.

All field seams shall be labelled by the Welding Technician according to the identification code on the panel layout, who shall record pertinent details relative to the weld, including:

- Welding Technician's initials
- Welding apparatus identification number
- Set temperature for fusion welders or nozzle temperature and preheat temperature for extrusion welders
- Ambient temperature measured 150 mm above the geomembrane
- Date and time welding of the seam commenced

The seam shall be allowed to cool naturally to ambient temperature before performing destructive testing described in 7.4.6. Failure of the field seam to meet the specified requirements shall require the Master Seamer to follow the procedure described in 7.4.6, and to withdraw the welding apparatus from service until a passing trial weld is obtained.

The QC Contractor shall monitor the pass/fail ratio of field seams with respect to geomembrane material, Welding Technician and welding apparatus, and the results shall be reported daily to the Engineer.

#### PS GM 7: Testing

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The Contractor shall supply with his tender, a Construction Quality Assurance/Control Plan which clearly indicates documentation ensuring compliance with the necessary material specifications, and control points requiring quality control checking during construction/installation.

The thickness of the liner sheet shall be tested before laying as verified by thickness conformance profiles as supplied by the manufacturers. The thickness of geomembrane liner shall be a minimum thickness, as measured in accordance with SANS 1526 (2003) Specification test method.

To ensure proper setting and calibration of welding equipment, a test weld approximately 2 m in length shall be run each day on material not forming part of the main membrane before welding on the main membrane commences.

Three samples will be taken from the test weld and tested by the Contractor using the vacuum test for extrusion/fusion joints and the air pressure test for Electric Double Wedge Seams.

PS GM 7.1: Vacuum Testing

This test creates a vacuum on one side of the joint. If a vacuum of minus 75 kPa can be maintained for three minutes the joint shall be considered effective. This test must be done where three sheets are lapped or where patching is done on straight runs at a rate of one test per 5 linear metre of welding.

PS GM 7.2: Electric Double Wedge Testing

Electric Double Wedge Testing is tested non-destructively by inflating the space between the two wedge welds and maintaining a certain pressure for a predetermined period of time.

PS GM 7.3: Peel Test

This test determines the effectiveness of the weld by peeling the weld apart at a rate of 50 mm/min on a strip 25 mm wide cut perpendicular to the joint direction.

An increasing force is applied to the two strips of membrane forming the joint. If one of the strips break prior to full separation across the weld, it is considered acceptable. If the weld separates the weld is considered unacceptable.

PS GM 7.4: Non-Destructive Seam Testing

Inspections and non-destructive tests shall be performed on the full length of all seams and repairs using air pressure, vacuum, water, spark, or other approved method. Inter-seam air-pressure tests shall be performed to test continuity on seams with an enclosed air space. Vacuum testing shall be performed to test continuity on seams that cannot be tested with air pressure due to the absence of an enclosed air space. Hydrostatic or spark testing shall be conducted on seams used to make pipe boots and other prefabricated pieces. In locations where seams cannot be non-destructively tested, the area shall be capped, if possible, as instructed by the Engineer. Seams that are accessible for testing prior to final installation of the geomembrane or prefabricated piece shall be tested before final installation.

Non-destructive testing shall be performed by the QC Contractor as the seaming progresses, and in no case shall it be undertaken more than 24 hours after the seam was made. The QC Contractor shall monitor the pass/fail ratio of non-destructive tests with respect to test type, geomembrane material, Welding Technician and welding apparatus, and the results shall be reported daily to the Engineer.

The non-destructive testing program shall include:

PS GM 7.4.1 Observation

Visual observations shall be made routinely and shall include the following:

- Visually check of field seams for squeeze out, foot print, melt and overlap
- Check machines for cleanliness, temperature, and related items

PS GM 7.4.2 Inter-Seam Air-Pressure Testing (Pressure Testing)

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Pressure testing equipment shall be capable of generating and sustaining an air pressure up to 275 kPa. The pressure test shall be performed according to the following procedure:

- Seal both ends of the seam to be tested.
- Insert a pressure gauge/needle assembly into the inter-seam void. Pressure test locations shall be at the extreme ends of the seams, and positioned in anchor trenches or at other non-critical locations.
- Apply an initial air pressure to the inter-seam void according to the following schedule. The initial air pressure shall be recorded after a 2-minute period to allow the air pressure and temperature to stabilize.

**Polyethylene Geomembrane Inter-Seam Pressure Schedule**

Nominal Geomembrane Thickness	Initial Pressure, Range		Maximum Difference Between Initial and Final Pressure
	Minimum	Maximum	
1.0 mm	165 kPa	200 kPa	28 kPa
1.5 mm	185 kPa	220 kPa	20 kPa
2.0 mm	205 kPa	240 kPa	14 kPa

- Five minutes after recording the initial pressure, the final pressure shall be recorded. If the difference between the initial and final pressure reading is more than the allowable difference contained in the above table, or the pressure does not stabilize, the seam shall fail. The location of the leak shall be found and repaired as described in 7.5, and the entire seam retested.
- Record details relative to the pressure test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date
  - Initial pressure and time
  - Final pressure and time
  - Pass/fail designation
- After the test is completed and with the pressure still applied, the end of the seam furthest from the pressure gauge shall be cut open to observe the presence of escaping air which serves to confirm the inter-seam channel is continuous. Alternatively, pressure gauges may be used at both ends of the seam during the test. If air does not escape, the blockage in the channel shall be located, and a pressure test performed on the untested part of the seam.
- Seal the penetration holes made by the pressure gauge/needle assembly by extrusion welding.

#### PS GM 7.4.3 Vacuum Testing

Vacuum testing equipment shall be capable of generating and sustaining a negative pressure of at least 34 kPa, or 250 mm of mercury, and is fitted with a translucent viewing window for observing the test. Vacuum testing equipment of various sizes and configurations shall be provided to test seams in all locations. The vacuum test shall be performed according to the following procedure:

- Trim excess overlap, if any, from the seam.
- Apply a generous amount of a strong solution of liquid detergent and water to the area to be tested.
- Place the vacuum box over the area and apply a slight amount of downward pressure to the box to seat the seal strip to the geomembrane.
- Apply a vacuum of at least 34 kPa to the area for a minimum of 10 seconds, and observe the seam through the viewing window for the presence of soap bubbles emitted from the seam. If no bubbles are observed, reposition the box over the next area to be tested with an overlap of at least 75 mm. If bubbles are observed, the area tested shall fail. The location of the leak shall be marked, repaired as described in 7.5, and retested.
- Record details relative to the vacuum test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date and time of test
  - Pass/fail designation

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#### PS GM 7.4.4 Spark Testing

Spark test must be performed on all extrusion welds. To perform the spark testing of extrusion welds, a 1,22-mm-diameter bare copper or stainless steel wire is embedded in the weld close to the overlap during the extrusion process. One end of the wire is left exposed and grounded. The spark test shall be performed according to the following procedure:

- Hold the electrode of the spark tester near the grounding source and set the voltage to a level that will enable the unit to generate a spark at least 1,5 to 2,0 times and the length of the longest anticipated leak path. (This is typically the distance from the wire to the outer edge of the weld bead.)
- Run the testing electrode along the length of the seam while maintaining contact between the electrode and the seam/membrane ensuring that the spark gap does not become too great for the voltage setting. If a spark is observed, the area tested shall fail. The location of the spark shall be marked, repaired as described in **Error! Reference source not found.**, and retested.
- Record details relative to the spark test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date and time of test
  - Voltage setting
  - Pass/fail designation

#### PS GM 7.4.5 Hydrostatic Testing

Hydrostatic testing shall be performed according to the following procedure after completion of welding of pipe boots and other prefabricated pieces:

- Raise and the perimeter of the piece at a height that will form a basin and allow the weld to be seen from below. The elevation of the perimeter shall be at least 200 mm higher than the weld to be tested.
- Slowly add sufficient water to the basin that is formed to submerge the weld being tested at least 100 mm.
- Monitor the weld for a period of at least 15 minutes. If a leak is observed, the weld tested shall fail. The location of the leak shall be marked, repaired as described in **Error! Reference source not found.**, and retested.
- The water shall be added and removed from the basin in such a manner that does not cause damage to the surrounding geomembrane or subgrade.
- Record details relative to the hydrostatic test in an area that will be visible after the piece is installed, including:
  - Tester's initials
  - Date and time of test
  - Pass/fail designation

#### PS GM 7.4.6 Destructive Seam Testing

Destructive tests shall be performed on samples cut from trial and field seams. Field seam samples shall be taken at a frequency not less than one sample per 100 metres, at locations identified by the Engineer. Destructive testing shall be performed by the QC Contractor as the seaming progresses, and in no case shall it be undertaken more than 24 hours after the test location has been marked by the Engineer. The QC Contractor shall monitor the pass/fail ratio of non-destructive tests with respect to test type, geomembrane material, Welding Technician and welding apparatus, and the results shall be reported daily to the Engineer.

Destructive test samples shall be a minimum of 600 mm long by 300 mm wide, with the seam centred lengthwise. The sample shall be cut into two 300 mm long pieces, with one piece used by the QC Contractor (QC Sample) for destructive testing as described and the other piece retained by the Engineer. An additional 300 mm by 300 mm sample may be cut, if requested by the Engineer, for independent laboratory testing. The sample shall be marked with a sample identification number, the seam number, and date and time. The QC Contractor shall accurately mark the sample location and sample identification number on the panel layout drawing.

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The destructive test shall be performed according to the following procedure:

- Cut 10 coupon specimens from the QC Contractor's sample using a coupon cutter and die.
- Test and examine 5 coupons for conformance to the shear requirements contained in **Error! Reference source not found.**. If any of the test results for any of the coupons fail to conform, the seam shall fail. In the event of a failure, the procedure outlined below shall be followed.
- Test and examine 5 coupons for conformance to the peel requirements contained in **Error! Reference source not found.**. Seams with enclosed air space shall have each weld tested in peel. If any of the test results for any of the coupons fail to conform, the seam shall fail. In the event of a failure, the procedure outlined below shall be followed.
- Record details relative to the destructive test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date and time sample taken
  - Pass/fail designation.
- Repair the area where the sample was taken, as described in 7.5.

The procedure outlined below shall be followed when there is a destructive test failure:

- Perform two additional destructive seam tests according the procedure outlined above, one on each side of the failed test location, and at least 3,0 metres from the failed test. If either of the additional tests fails, additional samples shall be taken in accordance with the above procedure until two passing tests are achieved to establish a zone in which the seam shall be repaired as described in 7.5. In lieu of taking an excessive number of samples, with the approval of the Engineer, the entire seam may be repaired.
- Record details relative to the destructive test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date and time sample taken
  - Pass/fail designation.

#### PS GM 7.4.7 Verification of Repairs

Repairs shall be non-destructively tested according to 7.5. In cases where the repaired seam exceeds 50 metres in length, the Engineer may require that a destructive test be performed according to 7.4.6 from within the zone in which the seam was repaired. Repairs that fail the tests shall be repaired and retested until a passing test result is obtained.

#### PS GM 7.5 Repairs

##### PS GM 7.5.1 General

Any portion of the geomembrane or seam showing a defect, or having a failed destructive or non-destructive test shall be repaired. Reasons for requiring repairs to the geomembrane installation include, but are not limited to:

- A failed non-destructive seam test
- A destructive seam test
- Seam intersections
- A hole, tear, or penetration, including holes in the seam for air pressure testing device
- A scratch, gouge, or nick that penetrates more than 10 percent of the material thickness
- A hard object underneath the geomembrane
- A fish mouth or wrinkle at seam overlaps
- Insufficient overlap
- Bridging
- Excessive scuffing
- Geomembrane material defects
- Large wrinkles

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Panels that require more than one repair per 25 m<sup>2</sup> shall, if instructed by the Engineer, be removed and replaced with new geomembrane at the Contractor's expense.

All repairs shall be labeled by the Welding Technician, who shall record pertinent details relative to the weld, including:

- Welding Technician's initials
- Welding apparatus identification number
- Set temperature for fusion welders or nozzle temperature and preheat temperature for extrusion welders
- Ambient temperature measured 150 mm above the geomembrane
- Date and time welding of the repair commenced

#### PS GM 7.5.2 Repair Methods

Agreement on the appropriate repair and welding method shall be reached between the Contractor and the Engineer. The seams used to make repairs shall conform to the requirements of **Error! Reference source not found.** Repairs shall be undertaken using one or a combination of the following methods:

#### PS GM 7.5.3 Patching

Used to repair large holes or tears, destructive test locations, fish mouths, wrinkles, seam intersections, insufficient overlap, bridging, and geomembrane material defects.

Fish mouths and wrinkles shall be cut along the ridge of the wrinkle to achieve a flat overlap. The cut shall be extrusion welded before applying a patch. Where there is a hard object underneath the geomembrane, the geomembrane shall be cut, the object removed, and the hole patched. If the object is thought to be a lump of soil that can be broken up with the heel of a boot, the geomembrane need not be cut. The resulting stress point or hole shall be patched or spot welded as required by the Engineer.

Patching shall comprise installing a new piece of geomembrane of the same material type and thickness over the area to be repaired, and welding it to the underlying geomembrane by extrusion welding. Patches shall be large enough to extend a minimum of 150 mm beyond the limits of the area being repaired, and shall have smoothly rounded corners with a radius exceeding 150 mm.

No patches shall overlap. If this is required to make a repair, the entire area, including all previous patches in the near vicinity, shall be covered with a single large patch. Deviations from this requirement shall be approved by the Engineer.

#### PS GM 7.5.4 Grinding and Re-welding

Used to repair small sections of seams made with extrusion welds.

The length of weld to be repaired shall be abraded without removing more than 10 percent of the geomembrane thickness before re-welding the seam.

#### PS GM 7.5.5 Spot Welding

Used to repair a scratch, gouge, or nick that penetrates more than 10 percent of the material thickness, but does not fully penetrate the geomembrane. An exception is a pinhole or a hole made by the pressure testing device.

The spot to be repaired shall be abraded without removing more than 10 percent of the geomembrane thickness before applying an extrudate bead.

#### PS GM 7.5.6 Capping

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Used to repair long failed seams, or a series of destructive test sample holes.

Patching shall comprise installing a new piece of geomembrane of the same material type and thickness over the area to be repaired, and welding it to the underlying geomembrane by fusion or extrusion welding. If fusion welding is approved by the Engineer, a hole may be cut in the geomembrane for inserting the welding apparatus. The insertion hole shall be patched. The cap shall be large enough to extend a minimum of 600 mm beyond the end of the failed seam, and shall have a minimum width of 900 mm. Any cap that is wider than 1,5 metres shall be considered a new panel and shall be shown on the panel layout drawing.

**PS GM 7.5.7 Seam Replacement**

Used to repair long failed seams in lieu of capping, with approval of the Engineer.

Seam replacement shall be performed by removing the failed seam and a 1,5 metres wide strip of geomembrane. A new strip of geomembrane of the same material type and thickness shall be inserted and welded to the adjacent geomembrane by fusion welding. The replaced material shall be considered a new panel and shall be shown on the panel layout drawing.

**PS GM 7.5.8 Flap Welding**

Used to repair long failed seams in lieu of capping, and may only be used in limited circumstances, with prior approval of the Engineer.

Flap welding shall be performed by welding the seam overlap flap of the failed seam to the underlying geomembrane by extrusion welding.

**PS GM 7.5.9 Seam Reconstruction**

Used to repair long failed seams in lieu of capping, and may only be used in limited circumstances, with prior approval of the Engineer.

Seam reconstruction shall be performed by removing the failed seam and the minimum possible strip of geomembrane. The remaining geomembrane shall then be pulled together and seamed using fusion welding. The Contractor shall demonstrate to the satisfaction Engineer that pulling the panels will not cause damage to the geomembrane or any other portion of the installation.

**PS GM 7.5.10 Large Wrinkles**

When seaming of the geomembrane is completed (or when seaming of a large area of the geomembranes is completed) and prior to placing overlying materials, The CQA officer will observe the sizes and distribution of geomembrane wrinkles. The CQA officer will discuss with the Engineer which wrinkles should be cut and re-seamed by the Installer at his cost. The seam thus produced will be tested like any other seam.

The wrinkle height to width ratio for the installed geomembrane shall not exceed 0.5. In addition, geomembrane wrinkles shall not exceed 100mm in height. Wrinkles that do not meet the above criteria shall be cut out and repaired in accordance with the Installer's approved QC manual.

**PS GM 7.5.11 Bridging of Geomembrane**

Bridging or trampolining of the geomembrane at any temperature higher than the design minimum service temperature or higher than the expected covering temperature at any location at any time shall be considered unacceptable. Compensating material will be installed at these locations. The geomembrane must be fully supported by the subgrade at the time of covering with liquid or soil. The minimum service temperature includes any period (after acceptance of the installation by the owner) when the liner is uncovered even though final service may involve covering the liner.

**PS GM 7.6 Anchor Trench Backfill**

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Prior to backfilling termination or anchor trenches, the Contractor shall inspect, with the earthworks contractor, QC Contractor and Engineer, all trenches to be backfilled, and the Contractor shall certify in writing that the trench is ready to be backfilled. The responsibility for maintenance of the accepted trench is described in the Project Specification.

Sandbags used to ballast the geosynthetics shall be removed by the geosynthetics contractor from the trench during backfilling at a rate commensurate with backfilling so that the geosynthetics do not pull out of the trench.

PS GM 7.6 Wear Sheets

Where shown on the Drawings, or required by the Engineer, the Contractor shall install wear sheets of material type and thickness specified. Prior to installing wear sheets, the underlying geomembrane shall be tested and approved, and cleaned to remove any objects that may damage the geomembrane. The wear sheet shall be tacked the underlying geomembrane by extrusion welds of length and spacing shown on the Drawings. If no length or spacing is specified, tack welds shall be a minimum of 500 mm long on minimum 3-metre centres. Testing of the seams is not required.

PS GM 7.6 Cover Material

The cover materials shall be compatible as well as suitable for use over the geomembrane and placed in a manner appropriate to the particular subgrade. Regardless of the cover material, the uncovered edge of geomembrane panels shall be protected at the end of the working day with a waterproof sheet, which is adequately secured with ballasts.

PS GM 7.6.1 Protection Geosynthetic

Precaution shall be taken to prevent damage to the geomembrane by restricting the use of heavy equipment over the liner system. Installation of the overlying geosynthetic component (protection geotextile or geogrid) shall be done either using manual labour or lightweight, rubber-tyred equipment such as a 4-wheel all terrain vehicle (ATV). This vehicle can be driven directly on the geomembrane, provided the ATV makes no sudden stops, starts or turns. If such occurrences do occur, the CQA officer shall be notified immediately. The CQA officer will then inspect the possible damage and may instruct a repair in accordance with Item 4.7. No other mechanical plant shall ride on the geomembrane.

Smooth HDPE sheets may be dragged across the geomembrane surface with equipment or by hand labour during position. Similarly, the HDPE may be unrolled with the use of low ground pressure equipment.

PS GM 7.6.2 Earth Cover (to be executed by the main earthworks contractor)

A minimum thickness of 250 mm (or as indicated on the drawings) of clean, selected sand (approved by the CQA officer) shall be placed over the geomembrane and protection geotextile (as indicated on the drawings). The soil shall be free of sharp-edged stones greater than 10mm in size.

Soil cover shall only be placed when the liner temperature is less than 45° C and it shall be placed with low ground pressure equipment. This may require that the soil cover be placed only during the cool part of the day or at night. Care shall be taken to avoid damaging the geomembrane or geotextile by making sharp turns or pivots with equipment as well as sudden starts or stops.

Soils may be placed on the geomembrane by pushing with a track-dozer or by carefully placing it with a loader or a backhoe. The use of construction machinery directly over the geomembrane is strictly prohibited. A minimum thickness of 250 mm of cover shall be kept between heavy equipment and geomembrane at all times, except

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when final-grading. No heavy vehicles may be driven directly over the geomembrane until the proper thickness of cover has been placed.

Wrinkles in the geomembrane shall be prevented from folding over during the placement of cover material.

To prevent damage to the geomembrane, the initial lift(s) of soil cover shall not be compacted more than 85% of modified AASHTO density or as specified by the Engineer. Cover soil shall not be dropped from a height greater than 1m.

When covering geomembrane on sloped areas, cover shall be pushed up-slope to minimize tension on the geomembrane.

PS GM 7.7 Installation Warranty

Upon completion of the installation and testing program, and acceptance of the installation by the Owner, the Contractor shall provide a warrant of the quality of the geomembrane installation, and that the installation will not fail for a minimum period of 10 (ten) years from date of acceptance of installation. The warranty shall cover the cost of material, labour and equipment to replace the failed installation.

PS GM 7.8 Tolerances

The tolerances required in the supporting specifications shall apply.

The Works shall be finished to the Degree of Accuracy given in the Project Specifications, and the permissible deviations (PD) shall be within the limits given below for the Degree of Accuracy specified.

**Permissible Deviation (PD)**

	Degree of Accuracy		
	III	II	I
1. Geomembrane Overlap	2 0 mm	2 0 mm	2 0 mm

PS GM 7.9 Documentation

PS GM 7.9.1 General

An effective CQA plan depends largely on recognition of all construction activities that must be monitored, and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The Engineer will ensure that all quality assurance requirements have been addressed and satisfied.

PS GM 7.9.1 Daily Record keeping

Standard reporting procedures shall include preparation of daily reports that, at a minimum, will consist of:

- Field notes, including memoranda of meetings and/or discussions with the Contractor and GSM Installer.
- Observation logs and testing data sheets.
- Construction problem and solution data sheets.

This information must be regularly submitted to, and reviewed by the Engineer.

PS GM 7.9.1 Observation Logs and Testing Data Sheets

Observation logs and testing data sheets shall be prepared daily. At a minimum, these logs and data sheets shall include the following information:

- An identifying log/sheet number of cross-referencing and document control
- Date, client name, project name, location and other identification
- Data on weather conditions

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- A site plan showing all active work areas and test locations
- Descriptions and locations of on-going construction
- Equipment and personnel in each work area, including those of all related subcontractors
- Description and specific locations of areas, or units, of work being tested and/or observed and documented
- Locations where tests were undertaken and samples taken
- A summary of test results
- Calibrations of test equipment and actions taken as a result of any non-conformance
- Off-site materials received, including quality verification documentation
- Decisions made regarding acceptance of units of work and/or corrective actions to be taken in instances of non-conformance
- Signatures of CQA officer and CQC monitor

These logs must show all non-complying test results.

A comprehensive set of CQA logs shall be as follows:

- Manufacturer/GCL Installer Compliance Agreement
- Daily personnel attendance list
- Material inventory
- Conformance testing
- Subgrade acceptance
- Material deployment
- Trial Seaming
- Production seaming
- Repairs
- Non-destructive testing
- Destructive testing
- Laboratory test results
- Problems and Solutions
- Soil Cover placement
- Daily report

These documents shall provide fully traceable record of men, machines, machine settings, materials, and weather and test results, in the event of in-service operational problems.  
The CQA Officer shall incorporate all these logs in the CQA Final Report.

PS GM 7.10 CQA Final Report

PS GM 7.10.1 Submission of report

The CQA Final Report will be submitted by the Engineer to the Employer within 40 days of completion of installation of the lining system.

#### CQA Final Report Contents

At a minimum the CQA Final Report shall contain the following information:

- An outline of the project
- A description of the lining system
- Reference to the CQA Plan and other documents used
- Geosynthetic membrane and other geosynthetic materials specifications
- A summary of on-site CQA activities and quantities (samples, failing results)
- A photographic record of construction
- Manufacturer/Geomembrane Installer Compliance Agreement
- Subgrade acceptance certificates
- Copies of all logs
- All test results

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- Discussion of problems and solutions
- Record drawings
- Certificate statement

#### Record/As Built Drawings

The record drawings must show:

- The location of all geomembrane joints and the types of joints
- Geomembrane panel and roll numbers and geomembrane type
- The location of all geomembrane repairs and the types of repairs
- Toes of slopes
- Crests of slopes
- Location of anchor trenches
- Location and numbers of any geomembrane destructive test sample sites
- Construction details that differ from as-designed details

#### PS GM 8: Measurement and Payment

##### PS GM 8.1 Measurement

Quantities for payment will be measured to finished shapes, sections, and profiles as shown on the Drawings will be included in the measurements unless performed on the written instruction of the Engineer.

Final quantities for the payment will be determined by the Engineer from the pre-construction, intermediate, and post-construction surveys and the approved as-built drawings. The Contractor shall provide all personnel, equipment and materials required to make such surveys, measurements, and other computations as are necessary to determine all estimates of monthly and final payments for Work performed, or as requested from time to time by the Engineer. A copy of the survey data and calculations shall be provided to the Engineer. Failure on the part of the Contractor to submit its survey data to the Engineer before commencing work will be held to indicate that it is prepared to accept the volume provided by the Engineer for the purposes of measurement and payment.

The Engineer may conduct such checks on the Contractor's survey, measurements and calculations, as he considers necessary, to confirm their adequacy and accuracy. Any discrepancies in the survey data identified by the Engineer shall be resolved with the Contractor before the Contractor may proceed with Work in that area. In the event of such failure, no subsequent claim in this regard will be considered. The Contractor shall allow in its construction schedule for the Engineer to check the surveys, measurements and computations.

##### PS GM 8.1.1 Length

The measurement of length will be made along the centreline, adjusted for slope.

##### PS GM 8.1.1 Area

Unless geomembrane is deployed in simple geometric forms, area will be computed using a planimeter, survey methods, or other means as determined by the Engineer. The plan area measured will be adjusted for slope.

Measurement will not be made of geosynthetic waste, overlaps, patches, or scrap unless otherwise approved by the Engineer. Geosynthetics placed in trenches will be measured according to the embedded length shown on the Drawings multiplied by the length of the trench.

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PS GM 8.2 Payment

Items listed in the Schedule of Rates and Prices are deemed to cover all work indicated in the Drawings or detailed in the Contract. No additional items may be claimed by the Contractor and the Contractor must allow in the unit rates and prices for completing the Works in their entirety.

Notwithstanding the above, the Contractor declares that every unit rate and price submitted in the Schedule of Rates and Prices has been derived in a reasonable fashion and properly reflects the cost of doing the portion of the Work to which that unit rate or price pertains.

PS GM 8.3 Listed Payment Items

PS GM 8.3.1 Supply geomembrane

.....(m<sup>2</sup>)

Separate items will be listed for each structure or work area and for each geomembrane type and thickness. The rate shall cover the cost of material and consumables (such as welding rods/beads), delivery to and offloading at the Site.

PS GM 8.3.2 Install geomembrane

.....(m<sup>2</sup>)

Separate items will be listed for each structure or work area and for each geomembrane type and thickness. The rate shall cover the cost of storage, handling, and loading and transporting from the storage area to the work area, protecting the prepared subgrade, deployment, consumables (such as sandbags), and seaming.

PS GM 8.3.3 Install wear sheet

.....(m<sup>2</sup>)

Separate items will be listed for each structure or work area and for each geomembrane type and thickness. The rate shall cover the cost of deployment, seaming, and tack welding to underlying geomembrane.

PS GM 8.3.4 Fabricate and install pipe boots

.....(No.)

Separate items will be listed for each structure or work area and for each geomembrane type and thickness, and pipe diameter. The rate shall cover the cost of fabrication and installation, including clamps, bands, gaskets, etc.

PS GM 8.3.5 Supply and place (specify geomembrane thickness) HDPE geomembrane liner including all jointing, trimming laps, anchoring and wastage

.....(m<sup>2</sup>)

This item includes the cost of all plant, labour and materials required for the installation of the geomembrane liner as detailed on the contract drawings.

PS GM 8.3.6 Supply and place (specify geomembrane thickness) LLDPE geomembrane liner including all jointing, trimming laps, anchoring and wastage

.....(m<sup>2</sup>)

This item includes the cost of all plant, labour and materials required for the installation of the geomembrane floating cover as detailed on the contract drawings.

PS GM 8.3.7 Anchorage of bottom liner and floating cover according to detail, including all fixings

.....(m)

This item includes the cost of all plant, labour and materials required for the anchorage of the two geomembranes according to the Contractor's detail.

PS GM 8.3.8 Extra over PS GM 8.1 and PS GM 8.2 for working lining around pipes,

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openings etc. not exceeding 300mm diameter ..... (No.)

This item shall be an extra over rates for items PS GM 8.1 and PS GM 8.2 and includes full compensation for the extra work involved to work and fix the geomembranes around pipes and openings etc.

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## PS GS: GEOCELLS REINFORCEMENT

### Content

PS GS 1 Scope  
PS GS 2 Interpretations  
PS GS 3 Materials and Manufacturing  
PS GS 4 Packaging, Transportation, Handling and Storage  
PS GS 5 Construction  
PS GS 6 Tolerances  
PS GS 7 Testing  
PS GS 8 Measurement and Payment

### PS GS 1: Scope

This is a particular specification and covers the supply and installation of geosynthetic Geocells reinforcement material to be installed as the protection and ballast layer of the geocomposite lining systems for the Sanitary Landfill and Leachate Pond. It would also be installed in drainage channels as an erosion-control system.

### PS GS 2: Interpretations

#### PS GS 2.1: Supporting Specifications

The following supporting specifications, standards and guidelines shall, inter alia, form part of the contract document together with this Particular Specification:

##### Project Specification

- i) ISO 472 Plastics – Vocabulary
- j) GRI Standard GS15 - Test Methods, Test Properties and Testing Frequency for Geocells Made From High Density Polyethylene (HDPE) Strips
- k) GRI Standard GM19 - Standard Specification for Seam Strength and Related properties of Thermally Bonded Polyolefin Geomembranes
- l) Warranties for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes
- m) ASTM D746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
- n) ASTM D792 Standard Test Method for Specific Gravity and Density of Plastics by Displacement
- o) ASTM E831 Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis.
- p) ASTM D1505 Test Method for Density of Plastics by the Density-Gradient Technique
- q) ASTM D1603 Test Method for Carbon Black in Olefin Plastics
- r) ASTM D1621-04a Standard Test Method for Compressive Properties of Rigid Cellular Plastics
- s) ASTM D1639 Environmental Stress Crack Resistance
- t) ASTM D3895 Standard Test Method for Determining the Minimum Oxidative Induction Time of Geomembranes
- u) ASTM D4439 Standard Terminology for Geosynthetics.
- v) ASTM D5199-98 Standard Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes

#### PS GS 2.2: Application

This specification contains clauses that are generally applicable to the manufacture, supply and installation of geosynthetic Geocells reinforcement (GS).

### PS GS 3: Materials

#### PS GS 3.1: Properties of Geosynthetic Geocells Reinforcement (GS)

Geocells products are three-dimensional, expandable panels. When expanded during installation, the interconnected strips form the walls of a flexible, three-dimensional cellular structure into which specified infill materials are placed and compacted. This creates a free-draining system that holds infill materials in place

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and prevents mass movements by providing confinement through tensile reinforcement. Cellular confinement systems improve the structural and functional behaviour of soils and aggregate infill materials.

It shall consist of a Pure High Density Polyethylene (HDPE) incorporating an evenly dispersed carbon black content as well as time proven Ultra Violet stabilisers and anti-oxidants. Reprocessed or reground materials shall not be used.

PS GD 3.2: Materials Certification

The Lining Contractor shall submit documented certification that the geosynthetic geocells product supplied complies with the aforementioned specifications. This documentation shall be submitted prior to any installation of the product on site.

PS GD 3.3: Materials general

The geosynthetic geocells product is to be supplied to site in panels no less than 2.3 m expanded width to minimize the number of site joints required.

The purpose of the geosynthetic geocells reinforcement filled with a prescribed material is to provide a surface to protect the geomembrane liners against potential mechanical damage, to provide ballast to the exposed geomembrane liners and to provide confining pressure to the GCL layer. The physical and chemical characteristics of the geosynthetic geocells product and its jointing system must be such that it provides continuous coverage. As such the geosynthetic geocells product shall be resistant to degradation as a result of the temperature (25°C nominal) and chemical characteristics of the leachate, sunlight, ultra violet rays, ozone, airborne pollution and weathering.

**TABLE 1: REQUIRED GEOCELLS MADE FROM HIGH DENSITY POLYETHYLENE STRIPS**

Test Properties	Test Method	Test Value (S.I. Units)	Testing Frequency (minimum)
Wall Thickness Nominal – 10%)	GRI-GS14	1.25 mm	per bundle
Density (min. ave.)	ASTM D 1505/D 792	0.940 g/cc	90,000 kg
Seam Efficiency (min. ave.)	GRI-GS13	100%	9,000 kg
Tensile Properties (min. ave.) • yield strength • break strength • yield elongation • break elongation	ASTM D 6693 Type IV	18 kN/m 13 kN/m 12% 100%	9,000 kg
Tear Resistance (min. ave.)	ASTM D 1004	155 N	20,000 kg
Puncture Resistance (min. ave.)	ASTM D 4833	330 N	20,000 kg
Direct Shear Friction Angle	ASTM D 5321	30°	20,000 kg
Carbon Black Content (range)	ASTM D 4218	2-3%	9,000 kg
Carbon Black Dispersion	ASTM D 5596		20,000 kg
Oxidative Induction Time (OIT) (min. ave.) (a) Standard OIT — or — (b) High Pressure OIT	ASTM D 3895 ASTM D 5885	100 min. 400 min.	90,000 kg
Oven Aging at 85°C (5) (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	ASTM D 3895 ASTM D 5885	55% 80%	per formulation
UV Resistance (6) (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs	ASTM D 3895 ASTM D 5885	N.R. 50%	per formulation

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PS GD 3.4: Rigging Strings

Rigging String to be used shall be UV resistant, resist the impacts of leachate and be sufficient in strength to provide the necessary support and to prevent the filled geocells from sliding down embankments or steep slopes.

PS GD 3.5: Joint Nails

Where nails are required all wire used for making the joining nails shall be 2,6 mm in diameter and shall comply with the requirements of SABS 675 or equivalent of mild steel wire. Nails will not be required where the geocells cover geomembrane liner layers.

PS GD 3.6: Anchor Pegs

Anchor pegs shall be made from deformed high tensile steel rods, 10 mm or 8 mm in diameter according to the softness of the underlying material. The rate of application of pegs shall be 1 per square metre for the main area and 1 peg in every second cell in "tuck-in" terminating anchor trenches. The length of each peg is determined according to the in-situ material but shall not be shorter than cell depth plus 300 mm. The actual length of the anchor peg will be determined by the stability requirements of the Geocells placed against the embankment slope. The anchor peg steel shall comply with the requirements of SABS 920.

PS GD 3.7: Cement

Cement shall be ordinary Portland cement, which complies with the requirements of SABS 471 or equivalent.

PS GD 3.8: Sand

PS GD 3.8.1: Sand for concrete

Sand for concrete, cement slurry and cement mortar shall comply with the requirements of SABS 1083 or equivalent.

PS GD 3.8.2: Sand for blinding

Sand for blinding used for geocells mats shall not contain any deleterious impurities and shall be well graded.

PS GD 3.9: Stone for concrete

The stone to be used with geocells shall be clean, washed and single sized road stone, generally complying with the requirements of SABS 1083. Stone shall preferably be 9,5 mm or 13 mm.

PS GD 3.10: Concrete

Concrete work shall be carried out in accordance with the requirements of SABS 1200 G.

PS GS 4: Packaging, Transportation, Unloading and Storage

The geosynthetic geocells product shall be packaged, transported, unloaded and stored in accordance with the manufacturer's instructions.

PS GS 4.1: Packaging and Transportation

The bundles of geosynthetic geocells product shall be packaged so as to protect them from mechanical damage during transportation and handling. The GS bundles must be delivered to the working area of the site in their original packaging. Immediately prior to deployment, the packaging is to be carefully removed without damaging the product.

PS GS 4.2: Unloading

Before off-loading on site, the contractor must ensure that the off-loading equipment is adequate for handling the GS bundles without any risk of damaging them. The area where the GS is to be off-loaded and stored

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must have a smooth well-drained surface, free of rocks or any other protrusions which may damage the product. No special covering is necessary for geosynthetic geocells product.

After off-loading, the contractor shall conduct a surface observation of all bundles for defects and for damage. This inspection shall be conducted without unpacking the bundles unless defects or damages are found or suspected. The contractor shall inform the engineer and the manufacturer of any defects or damages. Repairs shall be made subject to approval by the engineer, otherwise damaged bundles shall be replaced at the contractor's cost.

PS GS 4.3: Storage

A designated storage area shall be established in a location such that on-site transportation and handling are minimised. The storage area should be protected from theft, vandalism, passage of vehicles, and be adjacent to the area to be lined. The GS bundles shall be stored lying flat and continuously supported.

PS GS 5: Construction

PS GS 5.1: Installation

The Contractor shall submit with his tender a detailed proposal on the method he proposes to use for installation of the geosynthetic geocells reinforcement product. Some of the aspects to be covered include:

- A floor plan clearly showing the intended layout of the GS, including orientation of strips, and positions of overlaps and joints.
- Placement of the GS without disturbance or damage to underlying layers and linings.
- Equipment and procedures used to place the GS.
- Placing of the GS on top of the geotextiles and geomembrane without damaging or disturbing these liner materials.

Where the geosynthetic geocells are installed on uncovered soil the surface on which the geocells are to be laid prior to their being filled with the prescribed material, shall be levelled to the depth shown on the drawings or as erected by the Engineer so as to present an even surface. Where required, a foundation trench along the toe of the embankment or wall shall be excavated to the dimensions shown on the drawings or indicated by the Engineer.

At the time of installation, each field panel or portion of a bundle of geosynthetic geocells shall be given an "identification code". Field panels are to be located in a manner consistent with the specification and best suited to the design layout. Field panels are to be placed one at a time, and each field panel is to be seamed immediately after placement to the adjoining panel (in order to minimise the number of non-seamed panels). The Contractor shall record the identification code, location and date of installation of each GS field panel.

Installation and seaming shall not take place in wet weather or in the presence of excessive moisture, blowing dust, or strong winds.

During installation, the Contractor shall ensure the following:

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- Any equipment used shall not damage the GS products by handling, trafficking, excessive heat, leakage of hydrocarbons (e.g. diesel, petrol, etc.), or other means.
- The prepared surface has not deteriorated since the acceptance inspection and is still acceptable immediately prior to placement of the GS.
- Any geomembrane and geotextile liner immediately underlying the GS is clean and free of debris.
- All personnel working on the geomembrane and GS shall not smoke, wear damaging shoes, or engage in any activities which could damage the geomembrane or GS.
- The method used to unpack the panels must not cause crimps in the GS, and must not damage the underlying geomembrane.
- The method used to place the panels shall minimise wrinkles or twists (especially differential wrinkles between adjacent panels).
- Adequate temporary loading and/or anchoring (e.g., sand bags, tyres), which will not damage the GS, must be placed to prevent unnecessary displacement and movement on the geotextile and geomembrane liners.

Each GS layer shall be inspected for damage after placement, prior to seaming. Damaged areas shall be marked, removed and repaired in accordance with the specifications. The locations of repaired sections shall be recorded in the quality control documentation.

Rolls shall be laid flat on the installed underlying geotextile or geomembrane liner without folds or wrinkles, with a standard overlap or seam as specified by the manufacturer in both longitudinal and transverse directions.

No vehicular traffic shall be allowed on the installed GS layer and walking on the GS layer must be kept to an absolute minimum. Acceptable installation therefore may be accomplished such that the GS is unpacked in front of backward moving equipment. If the installation equipment causes rutting of the sub-grade, the sub-grade must be restored to its original accepted condition before placement continues.

Care must be taken to minimise the extent to which the GS layer is dragged across the underlying geotextile or geomembrane liner in order to avoid damage to the GS and the underlying geotextile and geomembrane, and to prevent the formation of folds in the underlying liner.

The methods of constructing, stretching, placing in position and filling the geocells mats with slurry concrete or sand or rock shall generally be in accordance with the manufacturer's instructions which have been approved by the Engineer. The following is emphasised:

- It is essential that the Contractor ensures that the cells are rigged extremely taut. Rigging strings are not to be omitted. Rigging and pegging are required to prevent collapse of the cells during filling, to prevent the cells floating on the concrete and to ensure an intimate contact of the cells with the base.
- Packs shall be joined to each other as per manufacturer's instructions. It is not permitted to simply butt one pack against another else a weak construction joint will be formed.
- Geocells which do not butt to kerbing or similar will terminate in "tuck-in" terminating beams to the dimensions shown on the drawings or indicated by the Engineer. The geocells shall be feathered into the terminating beam to a minimum penetrating depth of 150 mm.

The layout and the tolerance for the layout of the geocell mats shall be as shown on the Drawings/Specifications or as indicated by the Engineer.

PS GD 5.2: Anchorage

The outer edge of the GS is to be anchored on the top of the slope or embankment by means of an anchor peg in areas as indicated on the drawings.

The GS is to be placed across the geomembrane anchor trench as per the details on the drawings..

The anchorage trench is to be backfilled and compacted in layers not exceeding 150mm thick, with selected material from the trench excavation.

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PS GD 5.3: Seaming

In general, field seams should be oriented parallel to the line of maximum slope. In corners and odd-shaped geometric locations, the number of seams should be minimised. No horizontal seams should be less than 1.5m from the toe of the slope or areas of potential stress concentrations, unless otherwise authorised. When full roll lengths do not extend past the toe of the slope, panel ends may be seamed provided the panel is cut at an angle greater than 45 degrees.

PS GD 5.4: Installation around penetrations and structures

The GS shall be cut away to fit neatly around penetrations and structures through the liner system. No welding or sealing of the GS is required around penetrations and structures through the lining system.

PS GD 5.4: Damage repair

Any repairs shall be in accordance with the manufacturer's instructions and subject to approval by the engineer.

PS GD 6: Tolerances

The tolerances required in the supporting specifications shall apply.

PS GD 7: Testing

The Contractor shall supply with his tender, a Construction Quality Assurance/Control Plan which clearly indicates documentation ensuring compliance with the necessary material specifications, and control points requiring quality control checking during construction/installation.

PS GS 8: Measurement and Payment

PS GS 8.1: Geosynthetic geocells reinforcement

(a) Description of type

- (i) Nominal 75mm deep and 245mm x 210mm cell dimension .....Unit: m<sup>2</sup>

The unit of measurement will be square metres of lined surface. No additional area shall be measured as overlaps and/or wastage. Similarly, no additional payment will be made for cutting GS around penetrations and structures which is measured separately.

This item includes full compensation for procuring, furnishing and placing or application of materials including cutting and wasting and bending up against structures, and preparing ends for fixing to structures and for all labour incidentals required for the installation or application of the geosynthetic geocells, complete as per manufacturer's specifications.

PS GS 8.2: Geosynthetic geocells reinforcement anchorage

(a) Description of type

- (i) Rigging strings .....Unit: m<sup>2</sup>

- (ii) Pegging rods .....Unit: No

Sufficient rigging string and pegging steel rods for all the tying and pegging of the geo-cell mats shall be supplied during the construction of the geo-cell structure.

Separate items will be scheduled for different structures or areas to be lined.

PS GS 8.2:

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Extra over PS GS 8.1 for cutting and trimming geosynthetic geocells around pipes, openings etc. not exceeding 300mm diameter .....Unit: No

This item shall be an extra over rate for item PS GS 8.1 and includes full compensation for the extra work involved to cut and trim the geosynthetic geocells around pipes and openings etc.

PS GD 8.3: Anchorage of geosynthetic geocells according to detail together with other liner components (excavation and backfilling measured elsewhere) .....Unit: m

This item includes the cost of all plant, labour and materials required for the anchorage of the geosynthetic geocells on top of the embankment or the anchor trench as detailed on the contract drawings.

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**PS GT: GEOTEXTILES****Content**

PS GT 1 Scope  
 PS GT 2 Supporting Specifications  
 PS GT 3 Materials and Manufacturing  
 PS GT 4 Packaging, Transportation, Handling and Storage  
 PS GT 5 Construction  
 PS GT 6 Tolerances  
 PS GT 7 Testing  
 PS GT 8 Measurement and Payment

**PS GT 1: Scope**

This specification covers the manufacture, supply and installation of the geotextiles as shown on the contract drawings.

**PS GT 2: Material Specification for Geotextiles**

The geotextile material is specified in three categories, Type A, B and C. The geotextiles shall be non-woven needle punched polyester or polyprop geotextile and shall comply with the following material specifications.

Table 1. Key specifications for Geotextile materials

	Units	Type A	Type B	Type C	Test Method
Pore Size, AOS ( $O_{95W}$ ) (Typical)	$\mu\text{m}$	155	130	75	SANS 12956:13 / ISO 12956:10
Minimum Permeability	$10^{-3} \text{ m/s}$	>4.0	>4.3	2.6	SANS 11058:13 / ISO 11058:10
Min. Trapezoidal tear (weakest direction) (Typical)	N	330	800	2100	ASTM D4533
Grab strength min strength (Typical)	N	730	1550	4700	ASTM D4632
Elongation	%	50 - 80	50 - 80	50 - 80	
Through flow (@ 50 mm head)	$\text{l/s/m}^2$	>125	>70	>20	SANS 11058:13 / ISO 11058:10
Min. CBR Puncture (Typical)	kN	2.2	4.8	>11.7	*SANS 12236:13 / MARV ISO 12236:06
Min. Tensile strength (weakest direction) (Typical)	kN/m	11.5	>26	>56	*SANS 1525:13 / ISO 10319:08
Liner thickness (under 2 kPa)	mm	1.5-1.8	3-4	>6	SANS 9863-1:13 / ISO 9863-1:05
UV Stability	70% strength retained after 1000 hours				ASTM D4355

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The Type A geotextile is to be used in all filtration applications and should have the materials properties as shown in table 1 above. It should be a non-woven material.

The Type B geotextile is to be used in all filtration and separation applications and should have the materials properties as shown in table 1 above. It should be non-woven material.

The Type C geotextile is to be used in all liner protection applications and should have the materials properties as shown in table 1 above. It may be a woven or a non-woven material.

Where products are tested under other test methods the methods and result should accompany the tender. The engineer retains the right to reject a test method and instruct the tenderer to have the product tested under the specified test.

Type B and C geotextiles must be stable in the presence of the chemicals typical found in the facility being constructed and should be resistant to attack from these chemicals.

PS GT 3: Construction

PS GT 3.1: Installation

The geotextile shall be delivered to site in rolls with the unique roll number, unit mass and product name clearly labelled on the surface of the roll. The roll shall be covered with an opaque plastic sheet to prevent damaged from sunlight. If the geotextile roll is exposed to sunlight, at the discretion of the engineer, the outer layers of the roll shall be cut off and discarded. The rolls shall be stored on a secure dry, free draining surface and shall be stored on wooden beams to prevent water damage.

Where the geotextile is being placed in the sub-grade layer, it may be deployed by machine. However, all wheel tracks shall be removed prior to the geotextile being deployed onto an area. Where the geotextile is being placed onto the geomembrane, it shall be deployed by hand so as not to damage the geomembrane in any way. Extra special care shall be taken by installer to prevent damage of the geomembrane. The geotextile shall be held in place with sandbags to prevent wind uplift. Should the geotextile be displaced by wind or any other force, the Engineer shall inspect the geotextile for damage and can instruct the installer to remove the damaged geotextile and deploy a new roll at the Installer's own cost.

All rolls (placed alongside one another or end-on-end) shall overlap by a minimum of 300 mm or sewn with polyester thread. The overlaps shall be in such a direction that cover soil, when placed on the geotextile, is not pushed into the join, under the top layer. The use of construction machinery directly over the geotextile is strictly prohibited. A minimum of 250mm of cover shall be kept between heavy equipment and the geotextile at all times. No heavy vehicles may be driven directly over the geotextile until the proper thickness of cover had been placed.

PS GT 4: Tolerances

The work shall be finished to the degree of accuracy as defined in the table

	Permissible Deviation
<u>Levels (vertical –dimensions)</u>	± 10 mm
Sub-grade layer	
Geosynthetic layers	± 5 mm
Sand protection layers	- 5 mm + 20 mm
<u>Plan (Horizontal dimensions)</u>	± 20 mm
Sub-grade layer	
Geosynthetic layers	± 20 mm

PS GT 5: Measurement and Payment

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PS GT 5.1: Basic Principles

The basic principles of measurement and payment for the geotextile layers is that the rates tendered shall cover the cost for all work described in this particular specification including all the testing and QC / QA required. The measurement and payment for the granular layers shall be made under SANS 1200 D and PSDB. The measured quantify for payment for the geotextile layers shall be the net area placed and the cost of overlapping and wastage etc. shall be deemed to be covered by the tendered rates.

PS GT 5.2 Scheduled Items

Geotextile (Type C) Protection to Geomembrane (Geomembrane Measured Elsewhere)

The tendered rate for the supply of the geotextile shall include full compensation for all materials, plan, labour and other incidental required to manufacture, purchased, transport, deliver, store the material on and / or off site, test or comply with all manufacturing and construction quality assurance and controlled requirement in full accordance with the relevant specifications, irrespective of the source of point of manufacture. Waste allowance, overlap etc. shall be deemed to be included in the tendered rate. The quantity measured for payment will be the net area placed.

The costs of freight, duty landing charges and rates of exchange shall be included in the tendered rate as well as an allowance for waste and overlap. Variations in these costs are dealt with under special materials (if applicable).

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## PV LANDFILL SOIL LINER

### CONTENTS

PV 1	SCOPE
PV 2	PREPARATION
PV 3	CONSTRUCTION OF LINER
PV 4	INTERNAL BUNDS
PV 5	TESTING

### PV 1 SCOPE

This section covers the preparation of the landfill surface, the laying of the leachate liner and its subsequent testing and finally, the laying of the drainage layer.

### PV 2 PREPARATION

Excavations must be to 500 mm below formation level, selecting and stockpiling suitable material. Prior to preparation of the soil liner, the Contractor is to ensure that the excavations are free draining. Should the excavations not be free draining, the liner may be damaged by water ponding on it for prolonged periods coupled with site plant moving over it. Should such damage occur due to poor drainage, the liner damage must be rectified at the Contractor's expense.

Once excavation to level is complete, the exposed surface shall be graded to the falls shown on the drawings (minimum 2 %). Thereafter it shall be ripped and scarified to a minimum depth of 150 mm, and recompact to 100 % Proctor Dry Density at optimum moisture content to optimum + 2 %.

### PV 3 CONSTRUCTION OF LINER

The Contractor shall select suitable clayey material from stockpile on site as directed by the Engineer, and shall place and compact this material in two 150mm thick layers. Material to be selected shall have a Plasticity Index of >10, a maximum particle size of 25mm, and shall be capable of achieving a maximum permeability of as close to  $1 \times 10^{-7}$  cm/s as possible when compacted to specification. Compaction shall be to a minimum density of 100 % Proctor Dry Density at optimum moisture content + 2 %.

Regular watering of the placed clay layers must be performed to keep them as close as possible to optimum moisture content. Furthermore, if it is required, the placed and compacted clay layers shall be covered with sand or plastic to prevent desiccation. This covering will be moved from area to area as required and removed before the placing and compacting of the following clay layer.

On the leachate monitoring area, the Contractor shall place over the completed clay layers and HDPE liner and protective a drainage layer comprising a 200mm thick layer of aggregate of 25mm-38mm in size.

### PV 4 INTERNAL BUNDS

Internal bunds are to be constructed from builder's rubble material as approved by the Engineer shall have the same compaction in 150mm layers.

### PV 5 TESTING

Unless otherwise specified, the Contractor shall make arrangements with a soils testing laboratory to undertake the following tests on the liner materials, and to pass the tests' results on to the Engineer as soon as they become available.

The costs for such tests shall be included in the rates tendered for the appropriate item in the Schedule of Quantities.

#### PV 5.1 MATERIAL FROM STOCKPILE

- One Foundation Indicator test per 4 000m<sup>3</sup> of compacted material.

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- b. One Standard Proctor compaction curve per 4 000m<sup>3</sup> of compacted material.
- c. One moisture content per 2 000m<sup>3</sup> of compacted material.

**PV 5.2 BASE PREPARATION AND COMPACTED LINER**

- a. One Permeability test (in-situ) : Double ring infiltrometer test, ASTM D5093, 1990
- b. One moisture content test per 750m<sup>2</sup> of compacted layer. (Nuclear Method - BS 1377 : 1990 Part 9 Method 2.5).
- c. One density test per 750m<sup>2</sup> of compacted layer. (Nuclear Method - BS 1377 : 1990 Part 9 Method 2.5).

Should any of the tests referred to above fail to comply with the specified requirements, the Contractor shall, at his own expense, remedy the failure, and submit a new test to the Engineer.

**PV 5.3 NOTES ON BASE PREPARATION OF COMPACTED LINER TESTS**

**Permeability test and compaction tests**

- Undisturbed core samples to be taken on as-built compacted clay liner.
- Tests at 60m centres (max).
- Sampling regions to be backfilled and recompacted to required moisture content and permeability.
- Measurement to be made after primary consolidation.
- Confining pressure < landfill design pressure

**Tests to the Employer's Account**

Where additional soil tests are required on natural materials from within the Contract site, the Contractor shall also make arrangements with a soils testing laboratory to undertake these tests, the costs of which will be met by the Employer. Payment for such tests will be per sample tested. Test results are to be reported to the Engineer.

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### **PART C3.3 DRAWINGS**

These Bidding Documents includes the following drawings.

List of Drawings		
Drawing Nr.	Drawing Name	Purpose
1103-CIV-100	Locality and Topographical Layout (v2)	Locality
1103-CIV-121	Liner reparation	Location of works

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## **PART C3.4 - HEALTH AND SAFETY SPECIFICATIONS**

### **Contents**

1. DEFINITIONS
2. INTRODUCTION
3. SCOPE OF THIS SPECIFICATION
4. LEGAL REQUIREMENTS AND REFERENCE DOCUMENTS
5. LETTER OF GOOD STANDING
6. NOTIFICATION OF CONSTRUCTION WORK
7. REVIEW OF SHE PERFORMANCE
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    - i. Designer of a structure responsibilities
  - g. The as appointed principal contractor
    - i. Construction manager
    - ii. Assistant construction manager
    - iii. Construction supervisor
    - iv. Assistant to construction supervisor
    - v. Health and safety officer
  - h. List of possible appointments

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i. Responsibilities of principal contractor

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11. COST OF HEALTH AND SAFETY
12. HEALTH AND SAFETY REPRESENTATIVES AND SAFETY COMMITTEES
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  - c. Incident management
  - d. Recording and investigation of Incidents
15. MEDICAL EVALUATION OF WORKERS
16. STACKING AND STORAGE
17. PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT
18. HEALTH AND SAFETY SIGNAGE
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20. CONSTRUCTION EMPLOYEES' FACILITIES
21. SITE HOUSEKEEPING
22. HANDLING AND STORAGE OF HAZARDOUS AND FLAMMABLE SUBSTANCES
23. INTOXICATION
24. MINIMUM ADMINISTRATIVE REQUIREMENTS

1) **DEFINITIONS**

Construction Regulations - the Occupational Health and Safety Act's, No 85 of 1993, Construction Regulations 2014 that has come into effect on August 7, 2014;

Agent – a competent person who acts as a representative for a client;

Client – any person for whom construction work is being performed;

Competent Person – a person who:

Has in respect of the work or task to be performed the required knowledge, training and experience and, where applicable, qualifications, specific to that work or task. Provided that where appropriate qualifications and training are registered in terms of the provisions of the National Qualification Framework Act, 2000 (Act No.67 of 2000), those qualifications and that training must be regarded as the required qualifications and training; and

Is familiar with the Act and with the applicable regulations made under the Act;

Construction Manager – a competent person responsible for the management of the physical construction processes and the coordination, administration and management of resources on a construction site;

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Construction site – a workplace where construction work is being performed;

Construction Supervisor – a competent person responsible for supervising construction activities on a construction site;

Construction vehicle – a vehicle used as a means of conveyance for transporting persons or material, or persons and material, on and off the construction site for the purposes of performing construction work;

Construction work – 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.
- the moving of earth, clearing of land, the making of excavation, piling or any similar civil engineering structure or type of work.

Contractor – an employer who performs construction work;

Design – in relation to any structure includes drawings, calculations, design details and specifications;

Designer – a competent person who:

- Prepares a design
- Checks and approves a design
- Arranges for a person at work under his or her control to prepare a design, including an employee of that person where he or she is the employer
- Designs temporary work, including its components
- An architect or engineer contributing to, or having overall responsibility for a design
- A building services engineer designing details or fixed plant
- A surveyor specifying articles or drawing up specifications
- A contractor carrying out design work as part of a design and building project
- And interior designer, shop-fitter or landscape architect

Excavation work – the making of any man-made cavity, trench, pit or depression formed by cutting, digging or scooping;

Fall prevention equipment – equipment used to prevent persons from falling from a fall risk position, including personal equipment, a body harness, lanyards, lifelines or physical equipment such as guardrails, screens, barricades, anchorages or similar equipment;

Fall protection plan – a documented plan, which includes and provides for

- All risks relating to working from a fall risk position, considering the nature of work undertaken
- The procedure and methods to be applied in order to eliminate the risk of falling
- A rescue plan and procedures;

Fall risk – any potential exposure to falling either from, off or into;

Health and safety file – a file or other record containing the information, in writing required by the Regulations;

Health and safety plan – site, activity or project specific documented plan in accordance with Client health and safety specification;

Health and safety specification - a site activity or project specific document prepared by Client pertaining to all health and safety requirements related to construction work;

Medical certificate of fitness - a certificate contemplated in regulation 7(8);

Mobile Plant - any machinery, appliance or other similar device that is able to move independently and is used for the purpose of performing construction work on a construction site;

Person day - one normal working shift of carrying out construction work by a person on a construction site;

Principal contractor - an employer appointed by the client to perform construction work;

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Professional Engineer or Professional Certificated Engineer - a person holding registration as either a Professional Engineer or Professional Certificated Engineer in terms of the Engineering Profession Act 2000 (Act No. 46 of 2000);

Professional Technologist - a person holding registration as a Professional Engineering Technologist in terms of the Engineering Profession Act, 2000;

Provincial Director - provincial director as defined in Regulation 1 of the General Administrative Regulations 2003;

Shoring – a system used to support the sides of an excavation and which is intended to prevent the cave-in or the collapse of the sides of an excavation

Structure - any building, steel or reinforced concrete structure (not being a building), railway line or siding, bridge, water works, 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;

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

The Act - the Occupational Health and Safety Act 1993 (Act No. 85 of 1993);

Tunnelling - construction of any tunnel beneath the natural surface of the earth for a purpose other than the searching for or winning of a mineral

## 2) INTRODUCTION

The objective of this specification is to ensure that the principal contractor and contractors achieve an acceptable level of safety performance.

This document forms an integral part of the contract and the principal contractor and contractor shall make it part of their contract with their subcontractors and suppliers.

Compliance to this document does not absolve the principal contractor and contractors to comply with the minimum legal requirements and the principal contractor and contractors remain responsible for the health and safety of their employees in terms of the Occupational Health and Safety Act 85 of 1993 and the Construction Regulations 2014 and any other requirements.

## 3) SCOPE OF THESE SPECIFICATIONS

These specifications are applicable to the specific scope of work for the Mbabane sanitary landfill repair, upgrade and cell construction project including management, planning, engineering, design and construction of projects.

The content of this specification has the objective to assist principal contractor and contractors entering into contracts with Client that they comply with the Occupational Health and Safety Act No. 85 of 1993.

Compliance with this document does not absolve the principal contractor and contractors from complying with minimum legal requirements and each employer remains responsible for the health and safety of his employees and those of his Mandataries.

The principal contractor and other contractors should therefore insist that the specification form part of any contract that he may have with other contractors and or suppliers.

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4) **LEGAL REQUIREMENTS AND REFERENCE DOCUMENTS**

All employers onsite have a moral and legal duty to ensure that their workplace is safe from hazards to the health and safety of their workers and shall as a minimum comply with the requirements of the Occupational Health and Safety Act 85 of 1993, its regulations and all associated standards as per Section 44 of the Act and any other legislation and industry accepted standards pertaining to their scope of work.

An updated copy of the Act and Construction Regulations 2014 must be kept on site.

5) **LETTER OF GOOD STANDING**

The principal contractor and contractors shall be in good standing with the Compensation Commissioner or approved organisation as required by the Compensation of Occupational Injuries and Diseases Act 130 of 1993 and the Construction Regulation 4(g) prior to commencement of work.

6) **NOTIFICATION OF CONSTRUCTION WORK CR4**

The appointed principal contractor must at least 7 days before that work is to be carried out notify the provincial director in writing in a form similar to Annexure 2

7) **REVIEW OF SHE PERFORMANCE**

**RISK ASSESSMENT**

Construction Regulation 2014 section 5.1.a. Client shall prepare a baseline risk assessment for an intended construction work project;

Construction Regulation 2014 section 9.1. The principal contractor and contractors performing construction work shall before the commencement of any construction work and during construction work, cause a risk assessment to be performed by a competent person appointed in writing and the risk assessment shall form part of the health and safety plan to be applied on the site and shall include at least –

The identification of the risks and hazards to which person's may be exposed to including ergonomic hazards;

The analysis and evaluation of the risks and hazards identified;

A documented plan of safe work procedures to mitigate, reduce or control the risks and hazards that have been identified;

A monitoring plan; and

A review plan;

To ensure safety of employees and compliance to legislation, the principal contractor and contractors will be required to conduct three types of risk assessments and all employees must be trained in the risk assessment via an induction programme and records of such must be kept for auditing purposes.

**a) Baseline Risk Assessment**

Before the commencement of construction work contractors must, taking into consideration the baseline risk assessment and these health and safety specification to develop a site specific risk assessment for all operations that have contracted for.

**b) Issue Based Risk Assessment**

An issue based risk assessment must be completed for any work that falls out of their original area of responsibility, or if changes in conditions arise or the need arises due to incidents that occurred during the construction phase.

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### c) Continuous Risk Assessment

In order to maintain a safe and incident free project, continuous risk assessment must be done and for example;

- Daily supervisors task specific risk assessment
- Arranged health and safety audits that take place at least once a month
- Daily site/tool/equipment/plant/facilities inspection
- Toolbox talks / Safety talks on a weekly basis
- General awareness programs, and
- Planned job observations.

### d) Daily Supervisors Task Specific Risk Assessment

It is required of the principal contractor and contractor supervisors to do a daily task specific risk assessment before any task commences in their area of responsibility during the daily task planning discussion. Participation and input of the team of workers is of critical importance.

This is to establish what activities are planned, what hazards and risks are attached to these activities and what precautionary measures should be taken.

This risk assessment must be recorded and the responsible supervisor and his team must sign this document as proof that they are aware of the hazards and risks of the planned task and that appropriate precautionary Action have been discussed and taken. Such proof must be kept in the safety file.

This risk assessment is compulsory before a task commences and work will be stopped if it has not been completed. Disciplinary action will be taken against the responsible construction manager or supervisor of the principal contractor or contractor if this risk assessment has not been completed.

### e) Inspections

The principal contractor and contractors must inspect sight/tool/equipment/plant/facilities on a daily/weekly/monthly basis as established in their baseline and issue based risk assessment for their scope of work to ensure that it is safe for use, create no has it and poses no risk to persons and property.

### f) Audits

Monthly audits

As per section 5 of the Construction Regulation 2014 Client and/or its Agent will be conducting monthly audit at times agreed with the principal contractor and the same will be done by the principal contractor on their appointed contractors.

The scope of the audits will focus on legal compliance and requirements of these specification and the principal contractor and contractors' scope of work and area of responsibility and accountability on this specific contract to ensure their health and safety plan and file has been implemented adhered to and maintained.

Client, its agent or the principal contractor reserves the right to conduct unannounced ad hoc audits and inspections as it deems necessary in the interest of health and safety onsite.

A representative of the principal contractor and contractors and where applicable irrelevant Health and Safety Representative must accompany the auditor on all audits.

Contractors have to audit the subcontractors as per above and keep records of these audits in their health and safety files, available on request.

### g) Reports

Detailed reports of the findings of audits and inspections shall be reported in writing within 7 days to the principal contractor site management and contractors. Results must be discussed at project management and health and safety meetings.

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Copies of audit reports shall be kept by the principal contractor and contractors in their health and safety file.

### **Non-conformance closeout reports**

Non-conformance is reported via audit or inspection reports as above must be closed out and a report sent to the auditor and the principal contractor management within the time prescribed by the auditor inspector or any authorised person.

## **8) STOP WORK NOTICE**

Client reserve the right through his agent, the principal contractor, safety officer or any person authorised thereto, to stop any operations on site including that of contractors' teams and persons, if the supervisors daily task specific risk assessment has not been completed or should it be found that any operations are unsafe and in non-compliance with legislation, their health and safety plan and this specification.

The stop work order will only be lifted after the construction manager or construction supervisor of the offending contractor has rectified the unsafe condition and have discussed the non-conformance with its workers in the form of a toolbox talk/relevant training and after proof has been provided of compliance to the person who issued this notice. Stop work notice will be sent to Client CEO and it's agent.

### **!!!! NOTE!!!!**

Any expenses incurred by Client due to any non-conformance by the principal contractor and/or contractor will be for the account of the offending party. Except for the work stoppage, in addition the Client may impose a financial penalty, terminate their contract, withholding payment until compliant or any appropriate action decided upon by Client CEO and it's agent.

## **9) SITE MANAGEMENT, SUPERVISION, APPOINTMENTS AND RESPONSIBILITIES**

### **a) Project participants and relationships**

Client is ultimately responsible for all aspects i.e. (not limited to) finance, planning, health and safety, environmental protection, engineering construction and will appoint persons, companies who will carry out the work.

### **b) List of participants**

- i) Health and safety agent
- ii) Designers
- iii) Principal contractor
- iv) Contractors
- v) Sub-contractors

### **c) Appointments and responsibilities**

#### **Client appointments**

- i) Health and safety agent
- ii) Designers and principal agent
- iii) Principal contractor

### **d) Client responsibilities as client**

Client shall

Prepare a Baseline risk assessment and a suitable site specific health and safety specification for the intended construction work based on the baseline risk assessment;

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Provide the designer with these health and safety specifications and ensure that the prepared health and safety specifications are taken into consideration during the design stage;

Ensure that the designer carries out all responsibilities required in Construction Regulations 6;

Before appointing any principal contractor ensure that the principal contractor has the necessary competencies and resources to carry out the construction work safely;

Ensure that the principal contractor is registered and in good standing with the compensation fund or with a licensed compensation insurer;

Before any work commences on a site, have the principal contractor health and safety plan and file approved for implementation;

Take reasonable steps to ensure that the principal contractor health and safety plan are implemented and maintained through monthly health and safety audits and document verification;

Where changes are brought about to the design or construction work, make sufficient health and safety information and appropriate resources available to execute the work safely; and

Take steps to ensure cooperation between all contractors appointed to enable each of those contractors to comply with these regulations;

Where Client requires additional work to be performed as a result of a design change or an error in construction due to the actions of Client ensure that sufficient safety information and appropriate additional resources are available to the principal contractor to execute the required work safely.

Where a fatality or permanent disabling injury occurs on a construction site, Client must ensure that a report as contemplated in section 24 of the Act, in accordance with regulations 8 and 9 of the General Administrative Regulations, 2013 is forwarded to the provincial director. This report shall include the measures that the contractor intends to implement to prevent a recurrence of such incident and to provide a safe working environment.

**e) Client appointed agent**

**i) Agent's responsibilities**

The agent shall:

Act as client representative and the duties that are imposed by construction regulation 2014 upon Client apply as far as reasonably practicable to the agent.

Manage the health and safety on a construction project for client.

**f) Client appointed designer**

**i) Designer of a structure responsibilities**

The designer shall:

Ensure that the applicable safety standards incorporated into these Regulations under section 44 of the Act are complied with in the design and take into consideration the health and safety specification of client

Before the contract is put out to tender make available in a report to client -

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All relevant health and safety information about the design of the relevant structure that may affect the pricing of the construction work;

The geotechnical-science aspects where appropriate;

The loading that the structure is designed to withstand;

Inform client in writing of any known or 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 work necessitating the use of dangerous procedures or materials as it is to the health and safety of person's 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 make line for that work to be performed to minimise the risk;

Carry out the necessary inspections at appropriate stages to verify that the construction of the relevant work is carried out in accordance with his design;

**g) Appointed principal contractor**

The principal contractor as principal contractor shall appoint

**1) Contractor construction manager**

A construction manager who is competent to identify the hazards and risks in the area of his responsibility and has the authority to take action to rectify any unsafe situation as required by Section 8 of the OHSACT. The construction manager will be responsible to ensure that construction is done in a safe manner as per section 8.1 of the Construction Regulation. A construction manager may only work on site that he has been appointed for.

**2) Assistant construction manager**

Where applicable an assistant to the construction manager who will assist the manager (CR 8.2) in the execution of his duties. An assistant construction manager may only work on the site that he has been appointed for.

**3) Construction supervisor**

A construction supervisor who is competent to identify the hazards and risks in the area of his responsibility and has the authority to take action to rectify any unsafe situation as required by section 8 of the OHSACT. The construction supervisor will be responsible to ensure that construction is done in a safe manner as per section 8.7 of the Construction Regulation. A construction supervisor may only work on the site that he has been appointed for.

**4) Assistant to construction supervisor**

Where applicable, an assistant to the construction supervisor (CR8.8) who will assist the manager in the execution of his duties. An assistant construction supervisor may only work on the site that he has been appointed for.

**5) Health and safety officer**

A safety officer (CR8.5) with relevant competence, to assist the principal contractor and contractors in the implementation and monitoring of the health and safety plan.

**Example list of possible appointments (not limited to)**

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An organogram with the potential candidates to be appointed in these positions shall be made part of the Health and Safety plan.

The person making the appointment is required to discuss the responsibilities and authorities with the appointee and it must be agreed upon with appointees and their after placed in the health and safety file and kept on site for audit purposes.

### **Responsibilities of the principal contractor**

The principal contractor shall

Provide Client a suitable, sufficiently documented site specific health and safety plan, based on the specifications which must be approved by client agent before work commences and be reviewed and updated by the principal contractor as work progresses;

Develop and update a health and safety file which must include all documentation required in terms of the act and it's regulations and these specifications;

On a pointing any other contractor in order to ensure compliance with the provisions of the Act –  
Provide contractors who are tendering to perform construction work for the with the relevant sections of health and safety specifications of client pertaining to the construction work which has to be performed;

Subcontractors to perform construction work who has the necessary competencies and resources to perform the construction work safely;

Ensure prior to work commencing that every contractor is registered and in good standing with a registered compensation fund;

Appoint each contractor in writing for the part of the project on the construction site;

Approve each contractors health and safety plan and file before they are allowed to commence with work and approval must be done in writing by the principal contractors health and safety agent or manage or adviser or officer and proof must be available in the principal contractors health and safety file;

Take reasonable steps to ensure that each contractor health and safety plan is implemented and maintained through monthly health and safety audits and document verification and provide a copy of the health and safety audit to the within 7 days after the audit;

Where changes are brought about to the design or construction work make sufficient health and safety information and appropriate resources available to execute the work safely;

Where client requires additional work to be performed as a result of a design change or an error in construction do its actions client shall ensure that sufficient safety information and appropriate additional resources are available to execute the required work safely;

Take reasonable steps to ensure cooperation between all contractors to enable each of those contractors to comply with these regulations;

Hand over a consolidated health and safety file to client upon completion of the construction work;

Where a fatality or permanent disabling injury occurs on the construction site the principal contractor must ensure that a report as contemplated in section 24 of the act in accordance with regulations 8 and 9 of the general administrative regulations 2013 is forwarded to the provincial director. This report shall include the measures that the contractor

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intends to implement to prevent a recurrence of such incident and to provide a safe work environment. The incident must be reported to the client or his agent as soon as possible but within 24 hours.

## 10) COMPETENCE AND TRAINING

### a) Induction

The principal contractor shall ensure that all site personnel and visitors undergo project specific induction before starting work or entering the site. A record of attendance shall be kept in the health and safety file.

### b) Awareness (Toolbox talks)

Contractor and contractors shall ensure that relevant toolbox talks which deals with the hazards risks and safe work procedures specific to their activities take place at least once per week.

### c) Competency

#### Definition

A competent person is a person who has in respect of the work or tasks to be performed the required knowledge training and experience and where applicable qualification specific to that work or task. Appropriate qualifications and Training or registered in terms of the provisions of the National Qualification Framework Act, 2000 (Act No. 67 of 2000), those qualifications and that training must be regarded as the required qualifications and training.

The principal contractor and contractors shall

Ensure that their employees appointed are competent and that all training required to do the work safely and without risk to health of their or other persons has been successfully completed before work commences;

Ensure that all operators, drivers and users of construction vehicles, mobile plant and other equipment must be in possession of valid proof of training, valid licences and/or certificates of the correct code where machinery, plant or equipment is utilised;

Proof of these licences and/or certificates and/or proof of competence will be kept in the Contractors Health, Safety file.

## 11) COST OF HEALTH AND SAFETY

Client shall ensure the potential principal contractors offering a tender for proposed work have made adequate provision for the cost of health and safety measures in terms of his/her documented health and safety plan and measures based on these health and safety specifications during the period of the project.

The cost shall be duly quantified and clearly identified for such for example, medicals, PPE, training, special equipment etc.

The same rule on cost of health and safety applies to the principal contractor when contractors and its subcontractors making a bid for work on this contract.

## 12) HEALTH AND SAFETY REPRESENTATIVES AND SAFETY COMMITTEES

If the principal contractor or contractors as employees has more than 20 employees on site, he/she shall ensure that Health and Safety Representatives is appointed in writing and necessary training is provided a proof of such training shall be kept on site.

Irrespective whether the principal contractor or contractors has more than 20 workers employed on-site it is required that at least one Health and Safety Representative is appointed who shall form part and attend the joint health and safety committee meeting of the principal contractor irrespective of the number of workers onsite.

The joint Health and Safety Committee meeting may form part of the site meetings held by the principal contractor and

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contractors and minutes agenda and attendance records of this meeting must be kept in the principal contractor and contractors health and safety file.

### 13) SHE MANAGEMENT PLANS

#### a) Health and safety plan

Based on the specifications a suitable documented health and safety plan will be submitted to client by the principal contractor this plan will address the hazards identified and include safe work procedures to mitigate reduce or control those hazards identified.

The same requirement exists between the principal contractor and contractors.

#### b) Traffic accommodation, public safety and access control

The principal contractor and contractors Health and Safety program must provide for public safety, safe traffic accommodation and safe work areas by pre-planning and setting out correct/appropriate hazard warning signs and appropriate barricading i.e. No Un-Authorised Entry, Danger, Construction Work in Progress, Excavation Warnings, Hardhat, Lifting Operations and Visitors to Report to Site Office, etc. to ensure safety at all times and the responsible person is the site supervisor.

Barricading onsite must be of high quality to ensure that hazard and risk areas are safe to public vehicles and workers.

Traffic control must be dealt with through placement of correct traffic signs and delineators and having flagman in the appropriate positions.

Road work must be planned to limit the interference with normal traffic and during peak traffic hours.

In accordance with the Act the health and safety programme has to make provision to ensure that entry to the site is refused to any un-authorized person or who appear unfit through alcohol and or drug use.

#### c) Working at height Fall protection plan

In accordance with the 2014 Construction Regulations the principal contractor and contractors –

Designate a competent person to be responsible for the preparation of a fall protection plan;

Ensure that the fall protection plan is implemented, amended where and when necessary and maintained as required; and

Take steps to ensure continued adherence to the fall protection plan.

A fall protection plan 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 risks identified per location;

A process for the evaluation of the employees' medical fitness necessary to work at a fall risk position and the records thereof;

A programme for the training of employees working from a fall risk position and the records thereof.

The principal contractor and contractors must ensure that –

The appointed construction manager CR 8.1 /construction supervisor CR 8.7 is in possession of most recently updated version of the fall protection plan;

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All unprotected openings in floors, edges are adequately guarded, fenced or barricaded or that similar means are used to safeguard any person from falling through such openings;

No person is required to work in a fall risk position unless such work is performed safely;

Fall prevention methods are in place;

Approved as suitable and of sufficient strength for the purpose for which they are being used.

**d) Environmental protection**

The principal Contractor and contractors has to perform their work in such a manner to prevent environmental pollution and damage of air water and land resources. It includes management of visual aesthetics, noise, solid waste, dust, radiant energy and radioactive materials as well as other pollutants and resources encountered or generated by the principal contractor and contractors.

**e) Excavations CR 13**

All requirements with regards to excavations are as set out in the Construction Regulation section 13 shall be complied with as a minimum and the principal contractor and contractors shall familiarise themselves with the content thereof and act accordingly.

Where excavations deeper than 1.5 m are made, this will be preceded by an issue based risk assessment and method statement to be approved by the client's agent a competent person appointed by the principal contractors.

The principal contractor and contractors will appoint a competent person to supervise and inspect all excavation work. The findings and recommendations of such inspections will be documented daily and records thereof will be kept for auditing purposes.

The principal contractor and contractors shall ensure that provision is made for barricading, shoring, dewatering and inspection of excavations.

Inspections are to be done in the following instances:

- Daily prior to each shift
- After unexpected fall of ground
- After substantial damage to supports
- After rainfall

The principal contractor and contractors shall erect warning signs next to an excavation within which persons are working or carrying out inspections or tests.

**14) EMERGENCY MANAGEMENT**

**a) Fire precautions**

It is essential for the principal contractor and contractors to properly investigate and plan its fire prevention and protection measures. Prevention and protection measures are intended respectively to prevent and restrict the devastating effects of fires and are therefore critical components of the principal contractor and contractors' health, safety and environmental management efforts.

The principal contractor and contractors should focus on fire prevention and should ensure that the following measures are in place:

A properly equipped and trained fire crew to assist in the suppression or containment of wildfires and to maintain fire mitigation measures.

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Ensure that staff are trained and capable of fighting fires.

Identify areas of high fire risk/hazards.

Identify activities in the project that could lead to the ignition of a fire and determine and then implement mitigatory measures.

#### **b) First aid management**

The Following First aid arrangements must be put into place:

The principal contractor and contractors shall have qualified first aiders (when more than 10 employees) and first aid equipment (if more than 5 employees) as required by the general safety regulations 3 and annexure thereto

The first aid box shall be inspected by a competent appointed person on a monthly basis and records kept in their health and safety files.

#### **c) Incident management**

Recording and investigation of incidents

The principal contractor and contractors shall:

The principal contractor and contractors' health and safety program must make provision for every incident to be investigated by a competent person who will be assisted by supervisors, workers, SHE representatives and other relevant persons.

Where an incident was caused by or occurred involving his staff or property, report all incidents where an employee is injured, has died or there has been damage to property to the client principal contractor immediately, but at least within 24 hours after the incident and as per Section 24 of the Act and General Administrative Regulation 8 by means of "Annexure A" to the inspectorate.

Forward a full investigation report within seven days of the incident to the inspectorate, Client and the principal contractor.

Provide Client and the principal contractor and with a monthly "incident/near miss" statistics report.

### **15) MEDICAL EVALUATION OF WORKERS**

The principal contractor and contractors must ensure that all his or her employees have a valid medical certificate of fitness specific to the construction work they are to perform he issued by an occupational health practitioner in the form of Annexure 3.

### **16) STACKING AND STORAGE**

The principal contractor and contractors Health and Safety program shall make provision that:

Adequate storage areas are provided and is under the supervision of an appointed stacking and storage supervisor;

Storage areas must be kept neat and under control;

Good Housekeeping principles are implemented and maintained in storage areas.

### **17) PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT**

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it is important to note that PPE is the least desirable option to prevent injuries or damage and therefore the principal contractor and contractors must take such steps as may be reasonably practicable to eliminate or mitigate any hazard or potential hazard to the safety or health of employees, before resorting to personal protective equipment;

You shall sure your employees are provided with adequate personal protective equipment for the work they perform in accordance with the HIRA outcomes and in accordance with the requirements of General Safety Regulation 2(1) of the OSHACT.

It is also the responsibility of the principal contractor and contractors to:

Inform workers of the potential risks involved in their work;

Provide them with PPE free of charge;

Provide continuous training, exercise control and enforce the wearing of PPE where necessary;

Instruct employees in the proper use, maintenance and limitations of the safety equipment;

Ensure that PPE is used as required.

A document with all the above information and the signature of the relevant workers will be kept in the site safety file.

#### 18) **HEALTH AND SAFETY SIGNAGE**

The principal contractor and contractor's health and safety program must provide for the relevant signs are placed correctly conspicuous areas in accordance with the risk assessment, for example:

- Relevant traffic control signage
- No unauthorised entry
- Hard hat area
- First aid facilities
- No smoking

#### 19) **PLANT MACHINERY AND EQUIPMENT**

##### **a) The principal contractor and contractor's equipment**

Plant is operated, maintained and managed under the supervision of a competent appointed person.

Only appointed drivers/operators who have a valid operator's competence certificates, drivers licences and certificate of medical fitness are allowed to operate sites.

All plant and equipment are required to be in good, safe working condition, maintained and serviced in accordance with manufacturer's specifications before it will be allowed to work onsite.

Daily inspection plant, machinery, equipment are required before start of shift and records must be kept in health and safety file.

##### **b) Hired plant and machinery**

The principal contractor and contractors shall:

Ensure that any hired plant and machinery used on site is safe for use. The necessary requirements as stipulated by the OHS Act 85/1993 and Construction Regulations 2014 shall apply.

Ensure that operators hired with machinery or competent and that certificates, proof of medicals completed, daily inspections and copies of ID documents are kept by the operator and in the site health and safety file.

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All relevant subcontractors must ensure the same.

## 20) CONSTRUCTION EMPLOYEES FACILITIES

Where applicable and reasonably practical the principal contractor and contractor shall:

Provide potable water on-site;

Ensure that at least one sanitary facility appropriately marked for each sex and for every 30 workers or part thereof;

In the case that workers are far removed from their homes and where adequate transportation between the site and their homes or other suitable living accommodation is not available, the principal contractor and contractors must provide reasonable and suitable living accommodation after consultation with the employees or employees representatives and at least one shower facility for every 15 persons for the workers;

The above Facilities must be kept in a clean, hygienic, safe condition and in a good state.

## 21) SITE HOUSEKEEPING

The principal contractor and contractors must ensure that:

Housekeeping is continuously implemented and maintained;

Materials and equipment is properly stored;

Scrap, waste and debris is removed 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;

An unimpeded workspace 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;

Openings in floors, hatchways, stairways and open sides of floors or buildings are barricaded, fences boarded over or provided with protection to prevent persons from falling.

## 22) HANDLING AND STORAGE OF HAZARDOUS AND FLAMMABLE CHEMICAL SUBSTANCES

The principal contractor and contractors shall:

Ensure that the use, transport, storage and disposal of HCS are carried out as prescribed in the HCS Regulations as well as applicable environmental legislation, SANS standards and recommendations in the Hazardous Material Survey;

Ensure that all there is a register kept for all hazardous chemicals used in their operations on site and that they all have material safety data sheets;

Provide suitable and adequate protective equipment when working in an area where hazardous chemicals and materials are being used;

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Ensure that its employees have familiarised themselves with the hazardous material data sheets applicable;

Ensure that users are aware of the hazards and precautions that need to be taken when using the chemicals and a competent hazardous chemical substance coordinator must be appointed;

That first aiders are aware of the MSDS's and how to treat HCS incidents appropriately. Copies of the MSDS's must be kept in the first aid box and in the store;

That containers are clearly labelled "flammable substances" must be stored separately, away from other materials and in a well ventilated area (appropriate cross ventilation).

## 23) INTOXICATION

No intoxicating substances of any form shall be allowed onsite.

Any person who appears to be under the influence of drugs or any conditions which may render, or be likely to render him incapable of taking care of himself or the persons under his charge or suspected of being intoxicated shall not be allowed onsite.

Any person required to take medication shall notify the relevant responsible person thereof, as well as the potential side effects of the medication.

Any person suffering from any illness/condition that may have a negative effect on his/her or any other person's health or safety performance must report this to his/her superior.

The principal contractor and contractors shall ensure that no person under his control shall bring any intoxicating substance onto site.

The principal contractor and contractors reserves the right to subject any person to testing for substance abuse and any person refusing to undergo such test will be removed from site or denied access to the site.

## 24) MINIMUM ADMINISTRATIVE REQUIREMENTS

The principal contractor and its contractors shall use the applicable health and safety information in this specification to develop and submit a suitable and sufficient health and safety plan and safety file for the scope of their work.

It is required that the document have a table of contents and that each section is separated with dividers.

The work performed by the principal contractor and contractors is subjected to South African legislation as well as these specifications as they relate to their scope of work on this project.

Client will evaluate, discuss and negotiate the health and safety plan and file with the principal contractor and after final approval issue and acceptance letter to the principal contractor.

The above is applicable between the principal contractor and its contractors and between the contractor and its subcontractors.

A copy of letter of approval must be presented to the construction manager/supervisor before commencement of work and kept in the health and safety file.

If the principal contractor or any contractor onsite is found in noncompliance with the above rule of approval, the principal contractor or contractor will be issued with a work stoppage notice and not be allowed to work onsite until they are in full compliance.

### !!!!NOTE!!!!

Example of content of a health and safety file (the following list serves as an example only and it is the principal contractor, contractors and subcontractors' responsibility to ensure that they have covered all aspects and requirements of legislation and governing bodies pertaining to their activities).

1. Scope of work
2. Company emergency numbers
3. Workers and contractors management
  - a. List of workers
  - b. Copies of workers medicals
  - c. Copies of ID documents
  - d. List of contractors

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4. Daily/Weekly/Monthly inspections of all tools, equipment, and plant used onsite
5. Non-conformance management
  - a. Workers non-conformance reports
  - b. Client non-conformance reports
  - c. Non-conformance close-out reports
6. Monthly safety statistics
7. PPE management
  - a. PPE issuing form
  - b. PPE inspection
  - c. PPE policy
8. Safety training records
  - a. Induction training material
  - b. Induction training
  - c. Toolbox talks
  - d. Emergency procedures
  - e. Small tool training
  - f. Risk training
  - g. Safe work procedure training
  - h. Working at height training
  - i. First aid training
  - j. Fire training
  - k. Plant operators training
  - l. Scaffold and formwork erector training
  - m. Legal liability training for supervisors
  - n. SHE rep training
  - o. Incident investigator training
  - p. PPE training
  - q. Policies training
9. Records of monthly safety meeting
  - a. Agendas
  - b. Minutes of meeting
  - c. Attendance registers
10. Monthly safety management/safety file audit result
11. Site safety inspection reports
12. Health and safety policy
13. Company and SHE organogram
14. Proof of good standing with compensation commissioner
15. Site risk assessment

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- a. Baseline
  - b. Issue based
  - c. Daily site supervisors task specific risk assessment
  - d. Risk methodology
  - e. List of four highest risks
- 16. Site safety specification
- 17. Safety management plans
  - a. Health and safety plan
  - b. Fall protection plan
  - c. Environmental plan
- 18. Scaffold and formwork design drawings
- 19. Copy of mandatory appointments
- 20. Copy of appointment by Client
- 21. Copy of contractors appointment
- 22. All health and safety appointments as per your scope of work
- 23. Method statements of your activities
- 24. Incident management
  - a. Incident management procedures
  - b. Site incident report list
  - c. Annex 2
  - d. WCL 2
  - e. Incident investigation report
- 25. Hazardous chemicals management
  - a. List of hazardous and flammable chemicals used onsite
  - b. MSDS
  - c. Hazardous chemicals handling procedures
- 26. Occupational Health and Safety Act
- 27. Construction Regulations 2014

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

### **PART C3.5. INSPECTIONS AND TESTS**

The following inspections and tests shall be performed:

**SEE SPECIFICATIONS ABOVE**

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Apart from the obligations of the specialized subcontractor to conform to the specifications as provided above the obligations of the two civil works contractors would be and not limited to:

- (a) Provide a smooth clay under laying surface with no sharp objects near the surface which could puncture the geomembrane,
- (b) Provide for a sharp object free 100 mm sand cover on top of the geomembrane, etc.

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# QUALITY CONTROL PROGRAMME AND SPECIFICATION FOR THE MANUFACTURE, SUPPLY, INSTALLATION AND TESTING OF THE GEOMEMBRANE LINER

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## QUALITY CONTROL PROGRAMME AND SPECIFICATION FOR THE MANUFACTURE, SUPPLY, INSTALLATION AND TESTING OF THE GEOMEMBRANE LINER

### 1) SCOPE

This specification covers the requirements for furnishing materials, equipment and services necessary and incidental to complete high-density polyethylene (HDPE) geomembrane installations, as part of the composite lining system for the Whein Town Sanitary Landfill.

### 2) INTERPRETATION

#### 2.1 Supporting References

The publications below form part of this specification to the extent referenced. Where a particular publication is referred to, that publication shall, unless otherwise stated, be the edition in effect 30 (thirty) days prior to the date of issue of this specification. Any contradictions between publications shall be submitted to the Engineer for decision.

- Project Specifications
- American Society for Testing and Materials (ASTM)
  - D638 Standard Test Method for Tensile Properties of Plastics
  - D696, Standard Test Method for Coefficient of Linear Thermal Expansion of Plastics Between – 30 °C and –30 °C with a Vitreous Silica Dilatometer.
  - D746 Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
  - D1204 Standard Test Method for Linear Dimensional Changes of Nonrigid Thermoplastic Sheet or Film at Elevated Temperature
  - D4437 Standard Practice for Determining the Integrity of Field Seams Used in joining Flexible Polymeric Sheet Geomembranes
  - D4439 Standard Terminology for Geosynthetics.
  - D5596 Standard Test Method for Microscopic Evaluation of the Dispersion of Carbon Black in Polyolefin Geosynthetics
  - D5617 Standard Test Method for Multi-Axial Tension Test for Geosynthetics.
  - E831 Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis.
  - GRI4 Test Method GM13, Standard specification for Test Properties, Testing Frequency and Recommended Warranty for High-density polyethylene (HDPE) Smooth and Textured Geomembranes.
  - ISO 472 Plastics – Vocabulary.

#### 2.2 Application

This specification contains clauses that are generally applicable to the manufacture, supply and installation of geomembrane liners.

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<sup>4</sup> Geosynthetic Research Institute

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## 2.3 Definitions

For the purposes of this specification, the definitions given in the Contract and the following definitions shall apply:

**"High Density Polyethylene Geomembrane (HDPE)"** is a planar, relatively impermeable, polymeric sheet used in contact with soil/rock and/or any other geotechnical material in civil engineering applications, which is manufactured from a polyethylene resin with a density of less than 0.940 g/cm<sup>3</sup>, but greater than 0.930 g/cm<sup>3</sup>.

**"Lot"** is a quantity of resin, usually the capacity of one railcar used in the manufacture of geomembrane that shall be identified on the geomembrane roll.

**"Master Seamer"** is the person in the Contractor's organisation who is responsible for all seaming operations, and shall possess the minimum qualifications required in the Project Specifications. The Master Seamer may also be the Superintendent as defined in the Project Specification.

**"Minimum Average Roll Value (MARV)"** is the property value calculated as Typical Roll Value minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed the Minimum Average Roll Value.

**"Panel"** is an unbroken unit of geomembrane that is seamed on the Site.

**"Prepared Subgrade"** is the layer of in situ material that underlies the geosynthetic liner.

**"Typical Roll Value (TRV)"** is the property value calculated as the mean, or average, obtained from test data for one roll.

**"Welding Technician"** is a person in the Contractor's organization who performs geomembrane welding operations, and shall possess the minimum qualifications required in the Project Specification.

**"Manufacturing Quality Control (MQC)"** is a planned system of inspections that is used to directly monitor and control the manufacture of a material which is factory-originated. It is normally performed by the manufacturer of geosynthetic materials and is necessary to ensure minimum (or maximum) specified values in the manufactured product. MQC refers to measures taken by the manufacturer to determine compliance with the requirements for materials and workmanship as stated in certification documents and contract specifications

**"Manufacturing Quality Assurance (MQA)"**, is a planned system of activities that provides assurance that the materials were constructed as specified in the certification documents and contract specifications. It includes inspections of the manufacturing facility, verifications, audits and evaluations of the raw materials (resins and additives) and geosynthetic products, to assess the quality of the manufactured materials. MQA refers to measures taken by the MQA organization to determine if the manufacturer is in compliance with the product certification and contract specifications for the project

## 3) GEOMEMBRANES MANUFACTURING, TRANSPORTATION AND STORAGE

### 3.1 Qualification of Geomembrane Manufacturer

Details of the Manufacturer shall be provided by the Geosynthetic Materials (GSM) Installer in the Data Sheets forming part of this Tender.

The Manufacturer shall be able to provide sufficient production capacity and qualified personnel to meet the demands of this project.

The Manufacturer shall be approved by the Engineer and the Employer and the following information is to be submitted:

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1. Corporate background and information
2. Manufacturing capabilities:
  - Information on plant size, equipment, number of shifts per day, capacity per shift, quality control manual for manufacturing
  - List of material properties, including certified test results
3. A list of at least 10 completed projects totaling a minimum area of 2,000,000 m<sup>2</sup> for which the Manufacturer has manufactured geomembrane materials from the same type as that proposed to be used for this Contract. For each facility, the following information will be provided:
  - Purpose of installation, its location and start/finish dates
  - Name of facility owner, project manager and engineer
  - Type, thickness and surface area of the installed geomembrane
4. Manufacturing Quality Control manuals and related documentation

### 3.2 Geomembrane Plant Audit

#### 3.2.1 Scope

The Engineer may perform an audit of the manufacturing and quality control procedures used by the Manufacturer, specifically for the production of the geomembranes to be used for installation at the Employer's facility. The Manufacturer shall give the Engineer at least one month's notice of the start of production of geomembranes for this project. QC tests shall be performed as the geomembranes are manufactured.

#### 3.2.2 Quality Control

The manufacturer shall make available to the Employer and Engineer, Manufacturing Quality Control manuals, which outline all quality procedures, to be implemented for the manufacture of the geomembranes.

The Manufacturer shall provide valid calibration certificates for laboratory testing equipment. The Engineer shall verify that, during select runs of material, all MQC procedures are performed.

#### 3.2.3 Manufacturing Process

In general, the Manufacturer shall provide access for the Engineer to all equipment used to manufacture the geomembranes. This does not include divulging trade secrets, formulations and procedures that are not commonly known as basic manufacturing processes.

The Engineer shall monitor production and testing of geomembrane material allocated for this project. If material for this project has already been manufactured, the Engineer shall monitor production of the same type of geomembrane on the same production line to verify that manufacturing controls are in place. Additional tests by one independent laboratory are also required before the material will be approved. The Engineer shall review the QC certificates and notify the Manufacturer in writing which geomembrane rolls are approved for shipping. The Engineer shall be allowed to monitor the loading of the geomembranes for shipping.

Where material, which has already been manufactured and has been delivered to storage in Liberia or elsewhere, the Engineer shall be furnished with the test results from an independent laboratory and the QC certificates and will notify the Manufacturer in writing which geomembrane rolls are approved for shipping from storage.

The Contractor/Installer shall obtain approval from the Engineer before the geomembrane material is loaded for shipping.

Polyethylene geomembrane shall be of the type specified on the Drawings, and shall be high-density polyethylene.

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### 3.3 Manufacturing of Geomembranes

#### 3.3.1 Resin Properties

The base resin shall be new, first quality, compounded and manufactured specifically for producing geomembrane, and supplied by the same manufacturer. The base resin, prior to the addition of carbon black, shall conform to the following requirements:

**Table 3.3.1: Compounded HDPE Resin Properties**

Property	ASTM Test Method	Value	MQ Test Frequency
Density, range	D1505	0,932 – 0,940 g/cm <sup>3</sup>	1 per Lot
Melt Flow Index <sup>1</sup> , max.	D1238	1,0 g/10 minutes	1 per Lot
Oxidative Induction Time <sup>2</sup> , min.	D3895	100 minutes	
<sup>1</sup> Using 2,16 kg at 190 <sup>o</sup> C.			
<sup>2</sup> At 200 <sup>o</sup> C in oxygen at 1 atmosphere.			

Internal Quality Assurance testing will be carried out by the geomembrane Manufacturer to demonstrate that the incoming resin meets this specification. The resin shall be virgin material with no more than 10 percent rework. If rework is used, it shall be of the same formulation as the parent material. No post-consumer resin of any type shall be added to the formulation.

#### 3.3.2 Geomembrane Properties

**The geomembrane shall be of high quality formulation polyethylene material, resistant to ultraviolet rays, manufactured of new, first-quality products, containing no plasticizers, fillers or extenders, and designed and manufactured specifically for the purpose of liquid containment in hydraulic structures.** A maximum of 3 percent total additives consisting of carbon black, anti-oxidants and heat stabilizers, with a maximum of 1 percent of additives other than carbon black, shall be permitted in the geomembrane.

The finished material shall be free of holes, blisters, undispersed raw materials, or any sign of contamination by foreign matter, and nicks and cuts on roll edges. The geomembrane material shall be supplied in rolls having a minimum width of 6,7 metres and shall have no factory seams.

The material shall be manufactured with or without surface texture as required on the Drawings, and shall conform to the following additional requirements:

Smooth geomembrane shall have no texture applied to its surfaces. The material provided as smooth HDPE geomembrane shall conform to the following requirements:

**Table 3.3.2: Material Specification for Smooth HDPE Geomembrane**

Property	ASTM Test Method	Value		MQ Test Frequency
Nominal Geomembrane Thickness		1,5 mm	2,0 mm	
Thickness:				
Minimum (average of all of 10 values)	D5199	1,5 mm	2,0 mm	Each Roll
Minimum (individual of any of 10 values)	D5199	1,35 mm	1,8 mm	Each Roll
Density, min.	D1505	0,94 g/cm <sup>3</sup>	0,94 g/cm <sup>3</sup>	90000 kg
Tensile Properties in each direction(1) (min ave.)	D6693 Type IV			
Yield Strength,		22 N/mm	29 N/mm	
Break Strength, min.		40 N/mm	53 N/mm	9000 kg

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**Table 3.3.2: Material Specification for Smooth HDPE Geomembrane**

Property	ASTM Test Method	Value		MQ Test Frequency
		1,5 mm	2,0 mm	
<b>Nominal Geomembrane Thickness</b>				
Yield Elongation, min. 33 mm gauge length		12 %	12 %	
Break Elongation, min. 50 mm gauge length		700 %	700 %	
Tear Resistance, min.	D1004	187 N	249 N	20000 kg
Puncture Resistance, min.	D4833	480 N	640 N	20000 kg
Environmental Stress Crack Resistance(2) (Constant Load), min.	D5397 Appendix	300 hours	300 hours	90000 kg
rittliness Temperature by Impact (Condition B), max.	D746	- 77° C	- 77° C	90000 kg
Dimensional Stability <sup>2</sup> , max. change in each direction	D1204	<2 %	<2 %	90000 kg
Carbon Black Content, range	D1603(3)	2.0 – 3.0 %	2.0 – 3.0 %	9000 kg
Carbon Black Dispersion	D5596	See Note 4	See Note 4	20000 kg
Oxidative Induction Time (OIT) (min. ave.) (5) (a) Standard OIT — or — (b) High Pressure OIT	D 3895  D 5885	100 min.  400 min.	100 min.  400 min.	90,000 kg
Oven Aging at 85°C (5), (6) (a) Standard OIT (min. ave.) - % retained after 90 days — or — (b) High Pressure OIT (min. ave.) - % retained after 90 days	D 5721 D 3895  D 5885	55%  80%	55%  80%	per each formulation
UV Resistance (7) (a) Standard OIT (min. ave.) — or — (b) High Pressure OIT (min. ave.) - % retained after 1600 hrs (9)	D 3895  D 5885	N.R. (8)  50%	N.R. (8)  50%	per each formulation
<p>(1) Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction Yield elongation is calculated using a gage length of 33 mm Break elongation is calculated using a gage length of 50 mm (2) The yield stress used to calculate the applied load for the SP-NCTL test should be the manufacturer's mean value via MQC testing. (3) Other methods such as D 4218 (muffle furnace) or microwave methods are acceptable if an appropriate correlation to D 1603 (tube furnace) can be established. (4) Carbon black dispersion (only near spherical agglomerates) for 10 different views: 9 in Categories 1 or 2 and 1 in Category 3 (5) The manufacturer has the option to select either one of the OIT methods listed to evaluate the antioxidant content in the geomembrane. (6) It is also recommended to evaluate samples at 30 and 60 days to compare with the 90 day response. (7) The condition of the test should be 20 hr. UV cycle at 75°C followed by 4 hr. condensation at 60°C. (8) Not recommended since the high temperature of the Std-OIT test produces an unrealistic result for some of the antioxidants in the UV exposed samples. (9) UV resistance is based on percent retained value regardless of the original HP-OIT value.</p>				

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Smooth geomembrane shall have good appearance qualities, and shall be free from such defects that would affect the specified properties.

### 3.3.3 Submittals

The geomembrane manufacturer shall issue Quality Control submissions to the Engineer and the QA Officer for each delivery of material.

Prior to the shipment of any geomembrane, the Manufacturer will provide the Engineer with the following:

- A certified properties sheet including, at a minimum, all specified properties, and test methods indicated in the specifications.
- The internal MQC sampling procedures, frequencies of testing, and results of testing of material supplied to the project.

The QA Officer will verify that:

- The property values certified by the Manufacturer are properly documented, the test methods used are acceptable and the geomembrane meets the Project Specifications.

**Geomembrane Manufacturer Tracking List** – Cross-referencing list delineating the corresponding resin used in the production of the rolls delivered.

**Manufacturing Quality Control Data** – The manufacturing quality control test data indicating the actual test values.

**Physical Properties Sheet** – The material specification for the geomembrane supplied in accordance with this specification and that no plasticizers, fillers, or extenders were added during the manufacture of the resin, geomembrane and extrudate rods and beads.

**Letter of Certification** – The letter indicating that the material is in conformance with the physical properties specified.

### 3.3.4 Testing

The geomembrane material shall be tested by the manufacturer for compliance with the specifications listed in Tables 3.3.1 and 3.3.2 by the test methods and frequencies indicated. The costs of these tests are to be included for in the tendered price.

Conformance Testing may, at the discretion of the Engineer, be carried out by an independent laboratory (MQA laboratory). Conformance testing is not an opportunity to reproduce the QC testing program. It is a check to provide confirmation that satisfactory material is delivered to the site. The testing frequency shall be at the discretion of the Engineer, but the frequency as indicated in Tables 3.3.1 and 3.3.2 can be used as a guideline. The name and address of the laboratory shall be approved by the Engineer. The Engineer has a right to reject any roll or production batch if the samples do not pass the conformance testing.

Conformance Testing will be performed **before** material is shipped from the Manufacturer's plant so that it may be used immediately on arrival at the site.

### 3.3.5 In-Plant Conformance Testing

The purpose of in-plant Material Conformance Test Sampling is to verify that geomembrane material which is designated for the Owner's project is confirmed as meeting the project specifications prior to shipment to the site. Thus barring a transportation accident, the geomembrane can be installed immediately it arrives on site.

The Manufacturer will make available all necessary personnel and equipment to assist the QA Officer in retrieving conformance samples of the geomembrane material.

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The QA Officer shall send to the MQA Laboratory conformance samples for testing. The frequency of sampling shall be at the discretion of the QA Officer but shall typically be between 10000 m<sup>2</sup> and 25000 m<sup>2</sup> of geomembrane. No material shall be shipped to the site until conformance test results are obtained.

The QA Officer shall report any non-conformance of sampling procedures as outlined in Section 3.3.6 to the Engineer.

### 3.3.6 On-site conformance testing

If in-plant conformance testing is not possible, upon delivery of the rolls of geomembranes to the site, the QA Officer will ensure that samples are removed at the frequency specified in the Project Specifications and forwarded to the MQA Laboratory for testing to ensure conformance to both the Project Specifications and the Manufacturer's list of guaranteed properties.

### 3.3.7 Sampling

Samples will be taken across the entire width of the roll and will not include the outer wrap of the roll. Unless otherwise specified, samples will be 500 mm long by the roll width. Specimens for testing will be taken across the full width of the sample.

If more than one resin type is used, each resin type shall be sampled at the same frequencies and tested.

If roll numbers are very different and non-sequential, consideration should be given to testing each block of roll numbers at the same frequency.

### 3.3.8 Test Results

The QA Officer will examine all results from laboratory conformance testing and will report any non-conformance to the Engineer.

The following procedure will apply whenever a sample fails a conformance test that is conducted by the MQA Laboratory:

- The Supplier will replace the roll of geomembrane that is in non-conformance with the specifications with a roll that meets specifications.
- The QA Officer will remove conformance samples for testing by the MQA Laboratory from the next higher and next lower numbered rolls. These two samples must both conform to specifications. If either of these samples fails, testing shall continue until the defective rolls are isolated. The Supplier, at no expense to the Owner, will replace these rolls. This additional conformance testing will be at the expense of the Supplier.
- The QA Officer will document actions taken in conjunction with conformance test failures.

### 3.3.9 Packaging and Identification

All geomembrane rolls shall be packaged in opaque moisture resistant plastic sleeves. The roll cores shall be sufficiently strong to resist collapse during transit and handling. The Engineer has the right to reject any roll if the core has collapsed or if the roll is damaged in any other way.

Before shipment, the manufacturer shall label each roll, both on the geomembrane roll and on the surface of the plastic protective sleeve. Labels shall be resistant to fading and moisture degradation to ensure legibility at the time of installation. At a minimum the roll labels shall identify the following:

- Product Name and Grade

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- Length and Width of roll
- Total weight of roll
- Production Lot number and Individual roll number

### 3.4 Transportation, Handling and Storage of Geomembrane Liners

#### 3.4.1 Transportation and handling of materials

The installer shall contact the supplier before shipment to determine if the unloading methods and equipment differs from that specified below. Significant deviations from these procedures shall be pre-approved by the Engineer in writing.

Geomembranes must be supported during the handling to ensure worker safety and to prevent damage to the product. Under no circumstances may the rolls be dragged, lifted from one end, lifted with only the forks of a lift truck or dropped on the ground from the delivery vehicle.

The QA officer shall verify that proper handling equipment exists which does not pose any danger to installation personnel or risk of damage or deformation to the liner material itself. Suitable handling equipment is described below:

**Spreader Bar Assembly** – A spreader bar assembly shall include a core pipe or bar and a spreader bar beam. The core pipe shall be used to uniformly support the roll when inserted through the geomembrane core while the spreader bar beam will prevent chains or straps from chafing the roll edges.

**Carpet Spike** – A carpet spike is a rigid pipe or rod with one end directly connected to a forklift or other handling equipment and the other end rounded off to allow easy insertion into roll material cores. If a carpet spike is used, it must be at least 3.0m long and inserted to its full length into the roll core to prevent excessive bending of the roll when lifted.

**Roller Cradles** – Roller cradles consist of two large diameter rollers spaced approximately 75 mm apart, which both support the geomembrane roll and allow it to unroll freely. The use of roller cradles will be permitted if the rollers support the entire width of the geomembrane roll.

**Straps** – Straps may be used to support the ends of spreader bars but are not recommended as the primary support mechanism. As straps may damage the geomembrane where wrapped around the roll and generally do not provide sufficient uniform support to prevent roll bending or deformation, great care must be exercised when this option is used.

#### 3.4.2 Inspection upon delivery

Each roll shall be visually inspected when unloaded to determine if any packaging or material has been damaged during transit. Possible product conditions and actions are listed below:

- Rolls, including the roll cores, exhibiting damage shall be marked and set aside for closer examination during employment. Minor rips or tears in the plastic packaging shall be repaired with moisture resistant tape before being placed in storage to prevent moisture damage.
- The presence of free-flowing water within any roll packaging shall require that the roll is set aside for further examination to ascertain the extent of any damage.
- Geomembrane rolls delivered to the project site shall be those indicated on geomembrane manufacturing quality control certificates.
- Repairs to damaged geomembrane rolls shall be performed in accordance with **Item 4.7** of this specification.

The Engineer reserves the right to reject any roll at any stage prior to installation should it exhibit any of the above damages or non-conformance.

#### 3.4.3 Storage

A designated storage area shall be established in a location such that on-site transportation and handling are minimised. The storage area should be protected from theft, vandalism, passage of vehicles, and be adjacent to the area to be lined. The geomembrane rolls shall be stored laying flat and continuously supported.

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### 3.5 Overview of Quality Assurance Submissions

#### 3.5.1 Manufacturing Quality Assurance Documentation

Geomembrane Manufacturing Quality Assurance (MQA) sampling and testing for compliance with this specification shall be co-ordinated by the Quality Assurance (QA) officer as necessary to support the Manufacturing Quality Control (MQC) data.

#### 3.5.2 Information required at tender

The following shall be submitted with the Tender:

- Statement of experience from the proposed geosynthetic membrane manufacturer/supplier.
- Statement of experience from the proposed geosynthetic membrane Installer.
- Statement of the details of the supplier/manufacturer of the geosynthetic membranes.
- This is to be submitted during the tender evaluation period on request from the engineer and no deviation from this will be allowed before the completion of the contract, special permission must be obtained in writing from the Engineer to obtain the geosynthetic membranes from another supplier. However, no change of unit rate of supply or installation will be allowed. The material supply costs and **contractor's** markup is also to be supplied.
- Geomembrane material specification sheet

#### 3.5.3 Submissions required before shipment

Prior to shipment, the Manufacturer will furnish the QA officer with Quality Control certificates covering each roll of geomembrane and welding rods provided. (NOTE: Tests do not have to be done on each roll, they simply need to be done according to the frequency, defined in Item 3.3. The Quality Control certificate will be signed by a responsible party employed by the Manufacturer, preferably the QC Laboratory Manager.

The Quality Control certificates will include:

- Resin manufacturer, resin type, resin lot number and geomembrane roll numbers.
- Results of QC tests. At a minimum, results will be given for thickness, specific gravity/density, uniaxial tensile strength and elongation at yield and break, single point stress rupture time, and carbon black content and dispersion, evaluated in accordance with the methods indicated in the specifications or equivalent methods previously approved by the Project Manager and QA officer. No material will be installed until complete QC test data have been approved by the Project Manager and CQAO. No material will be installed until complete QC data have been provided.

The QA officer will:

- Verify that the Quality Control certificates have been provided at the specified frequency for all rolls and that each certificate identifies the rolls and resin related to it:
- Review the QC certificates and verify that the certified roll properties meet the Manufacturer's and Project Specification

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#### 3.5.4 Extrudate Rods and Beads

The extrudate rods and beads shall be manufactured from the same resin type as the geomembrane, and additives shall be thoroughly dispersed throughout the material. Details of this must be provided in writing prior to the start of construction. The material shall be free of contamination by moisture and foreign matter.

#### 3.5.5 Materials Warranty

The Contractor shall request, and the geomembrane manufacturer shall provide a warrant of the quality of the geomembrane material, and that the material will not fail due to ultraviolet degradation for a minimum period of 10 (ten) years from date of acceptance of installation. The warranty shall cover the cost of material, labour and equipment to replace the failed geomembrane.

### 4) GEOMEMBRANE INSTALLATION

#### 4.1 Equipment

##### 4.1.1 General

The Contractor shall provide and maintain all equipment that is necessary and suitable for handling, installing, and testing geosynthetic membranes under the conditions found on the Site.

##### 4.1.2 Geomembrane Welding Equipment

The Contractor shall maintain on the Site, in fully operable condition, sufficient spare geomembrane welding equipment and generators so that the seaming operations are not adversely affected by equipment failures. As a minimum one spare welder in working condition for every five or less production welders, and one spare generator in working condition for every five or less production generators, shall be provided.

##### 4.1.3 Fusion Welding

The fusion welding equipment used shall be an automated, self-propelled device capable of operating unassisted on the slopes to be covered with geomembrane and equipped with a seaming speed controller and an electronic controller capable of continuously displaying, monitoring and controlling the temperature in the zone of contact where the machine is actually fusing the geomembrane material. In addition, the fusion welding equipment shall be capable of producing a seam with an enclosed air space.

##### 4.1.4 Extrusion Welding

The extrusion welding equipment used shall be equipped with two temperature gauges, each capable of continuously displaying the temperature, one at the pre-heat and the other at the extrudate.

##### 4.1.5 Heat Bonding

The temperature of the hot air at the heat nozzle of the heat bonding apparatus shall be capable of being controlled such that the geomembrane is not damaged.

##### 4.1.6 Generators

Power sources capable of providing constant voltage under the combined line load shall be used.

#### 4.2 Safety

The Contractor shall be solely and completely responsible, until completion of the Work, for the safety of its employees, the employees of others, and the public while they are in the Contractor's working areas. The Contractor is responsible

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to employ the proper systems and techniques and shall be solely responsible for the safety, adequacy, and cost of the methods employed.

The Contractor shall be aware of risks inherent in working with geomembrane, such as slipping, and shall provide suitable access by means of rope ladders and/or non-slip walking surfaces. Precautions shall be taken to prevent heat stroke and the effects of heat radiation from working on the geomembrane surface.

#### 4.3 Panel Layout

Prior to commencing geomembrane deployment the Contractor shall prepare and submit to the Engineer for approval a proposed panel layout drawing for each type of geomembrane and each layer showing the proposed deployment pattern and sequence, and general location of field seams. No deployment of geomembrane shall commence until the panel layout has been approved by the Engineer.

In preparing the panel layout, the Contractor shall take into account the construction schedule, access restrictions and the following limitations placed on seam locations:

- To the maximum extent possible, field seams shall be parallel to the slope
- The number of transverse field seams on slopes steeper than 6H:1V shall be minimized, and in this case the location of such seams shall be approved by the Engineer
- A minimum of 1,0 metre shall be provided from the toe of any slope steeper than 6H:1V before providing any transverse seam
- The field seams at inside and outside corners, odd-shaped geometric configurations, seam convergences, and small panels shall be avoided

Each panel, seam, and penetration shall be given a simple and logical identification code consistent with the panel layout drawing. The panel layout drawing shall be updated from time to time to reflect the actual deployment configuration and shall show the locations of destructive tests.

On completion of the installation the Lining Contractor/Installer shall prepare and submit to the Engineer as-built drawings to scale for each type of geomembrane and each layer, showing the final panel layout and test locations.

#### 4.4 Substrata Acceptance

##### 4.4.1 Prepared Subgrade Acceptance

Prior to deployment of geomembrane over the prepared subgrade, the Contractor shall inspect, with the earthworks contractor, QC Contractor and Engineer, all surfaces on and trenches in which the geomembrane is to be placed. The Contractor shall certify in writing that the prepared subgrade is acceptable for the installation of the geomembrane. Surfaces not in compliance with the Specifications shall be rectified by the earthworks contractor and be subjected to inspection and acceptance before geomembrane is deployed. The responsibility for maintenance of the accepted areas remains the responsibility of the Earthworks Contractor.

##### 4.4.2 In-Place Geosynthetics Surface Acceptance

Prior to deployment of geomembrane over in-place geosynthetics, the Contractor shall inspect, with the QC Contractor and Engineer, all in-place geosynthetics surfaces on and trenches in which the geomembrane is to be placed. The surface shall be clean and free of debris, and the in-place geosynthetic material shall not have deteriorated since it was first deployed. The Contractor shall certify in writing that the in-place geosynthetics surface is acceptable for the installation of the geomembrane. Surfaces not in compliance with the Specifications shall be rectified by the Contractor and be subjected to inspection and acceptance before geomembrane is deployed. The responsibility for maintenance of the accepted areas is described in the Project Specification.

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## 4.5 Deployment

The geomembrane shall be installed on the approved areas shown on the Drawings and according to the approved panel layout, or as directed by the Engineer, using methods and procedures that ensure a minimum of handling and to minimize the formation of wrinkles, especially differential wrinkles between adjacent panels.

Geomembrane deployment shall only proceed when ambient air temperatures measured are between 4 °C and 38 °C, unless approved by the Engineer.

The method used to unroll the geomembrane shall not cause scratches or crimps in the geomembrane and shall not damage the prepared subgrade or in-place geosynthetics. The geomembrane shall not be dragged over gravel, stones, debris or other material that could cause it damage. During deployment, the geomembrane shall be visually inspected by the CQC Contractor. Damaged, faulty or suspect areas shall be marked for testing and/or repair.

The geomembrane shall be placed one panel at a time in a relaxed condition with the required overlap so that it is in intimate contact with the underlying subgrade at all locations and free of tension or stress upon completion of the installation. All necessary precautions, including installing extra material, shall be taken to avoid bridging of geomembrane. Cutting and trimming of geomembrane placed over other geomembranes shall be undertaken with hooked-blade knives or other approved cutters. Special care shall be taken to protect other geosynthetic materials from damage that could be caused when cutting.

No equipment or procedures shall be used that could damage the geomembrane or excessive rutting of the prepared subgrade. Any equipment that has the potential to leak hydrocarbons shall be repaired, modified or removed from the Site. Areas of heavy foot traffic, under portable generators, and locations where portable welding machines, fuel cans, or tools are placed on the geomembrane, shall be protected with geotextile or geomembrane scraps. Personnel shall not engage in activities, e.g., smoking, or wear shoes that could damage the geomembrane. Vehicles shall not be permitted on the geomembrane.

All panels, whether welded or not, shall be securely ballasted and anchored at all times to prevent any wind uplift, movement, or slipping, using sandbags or other items that will not damage the geomembrane. The ballast material shall be provided by the Contractor.

Only the amount of geomembrane that can be seamed up by the end of the work day shall be deployed, unless otherwise approved by the Engineer, and the amount of geomembrane deployed without quality control and repairs being completed shall not exceed 20 000 m<sup>2</sup>.

## 4.6 Seaming

### 4.6.1 General

Geomembrane seams shall be created using thermal methods. A Master Seamer shall be on the Site and supervising seaming operations at all times when seaming operations are in progress. No Welding Technicians or welding apparatus shall be allowed to perform field seaming operations until the technicians and equipment have successfully completed prequalification and trial seams.

### 4.6.2 Welding Technician and Welding Apparatus Prequalification

When a Welding Technician arrives on the Site for the first time or after an absence from Site exceeding one month, he/she shall be prequalified in the presence of the QC Contractor by performing three consecutive passing trial welds for each geomembrane type and thickness to be welded by the technician.

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When a welding apparatus arrives on the Site for the first time, after repair, or after being removed from the Site, it shall be prequalified in the presence of the QC Contractor by performing three consecutive passing trial welds made according to **Error! Reference source not found.** for each geomembrane type and thickness to be welded by the apparatus.

A new or returning Welding Technician may be prequalified using an existing welding apparatus, and a new, repaired, or returning welding apparatus may be prequalified by a qualified Welding Technician.

A record shall be maintained of each geomembrane type and thickness for which each technician and apparatus has prequalified, and a technician or apparatus shall not be used for seaming operations for which it has not prequalified.

#### 4.6.3 Weather Restrictions

The Contractor shall take into account that rapid weather changes are possible at the Site, resulting in delays in production of field seams. Seaming shall only be undertaken under weather conditions allowing such work within the warranty limits imposed by the geomembrane manufacturer and which will not jeopardize the integrity of the geomembrane installation. Seaming shall not occur under adverse environmental conditions, including, but not limited to:

- Precipitation of any kind, including condensing fog
- Areas of ponded water
- Periods of excessive winds or dust
- Extreme heat or cold, unless trial and field seams are shown to produce acceptable and consistent results

#### 4.6.4 Preparation

Extreme care shall be taken by the Contractor in the preparation of the areas to be welded. The surface of the geomembrane in the area to be welded shall be cleaned and prepared, and shall be free of grease, moisture, dust, dirt, debris, and foreign material of any kind. Lint-free cloth rags shall be used for cleaning, and the Contractor shall supply at least one clean rag for every 30 metres of weld.

The area to be extrusion welded shall be roughened by grinding the surface no more than 30 minutes before welding. The roughened surface shall not extend beyond the extrudate bead and shall not remove more than 10 percent of the geomembrane thickness.

#### 4.6.5 Overlap

Adjacent panels shall be overlapped with the sufficient material required to perform the welding process, but in no case less than 125 mm for fusion welds and no case less than 75 mm for extrusion welds. To facilitate overlap control, the edge of deployed panels shall be marked at regular intervals with a mark showing the required overlap.

Overlaps shall be shingled in the direction of anticipated water flow in floors with a fall.

#### 4.6.6 Anchorage

The outer edges of the geomembrane liners are to be anchored in the same anchor trench (400mm x 400mm minimum) at the top of the slope, together with the other components of the lining system, as shown on the drawings. The front edge of the trench is to be rounded, so as to prevent stress concentrations on the geomembranes.

The geomembranes are to be placed in the trench such that they cover the entire trench floor, and extend up the rear trench wall.

The anchorage trench is to be backfilled and compacted in layers not exceeding 150mm thick, with selected material from the trench excavation. To minimise material bridging at the toe of the slope and the formation of wrinkles,

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backfilling of the anchor trench should be carried out during the cool of the morning or extended period of overcast skies. Care must be taken during backfilling of anchor trenches to prevent any damage to the geosynthetic lining components.

#### 4.6.7 Penetrations

Penetration details are given on the drawings for this contract and must be adhered to. Where factory welding of geomembranes to HDPE plates is required, such welding must be strictly controlled, the HDPE plate is to be pre-heated as required, and welds are to X-rayed to prove their effectiveness and approved by the Engineer before transportation to site.

#### 4.6.8 Placement on top of Geomembranes

Placement of subsequent geosynthetic layers, drainage media or soil on top of installed geomembrane liners shall not take place until all destructive and non-destructive testing has been completed and the geomembrane accepted.

Placement of material over the geomembrane shall be performed so as to minimise wrinkles. If a wrinkle forms, every effort shall be made to walk the wrinkle out prior to placement of material over the geomembrane. Minor folding over of wrinkles is acceptable, provided that an even transition occurs at the tail of the wrinkle. If excessive stress points are created at the tail of a wrinkle, the wrinkle should be cut out and repaired as specified.

Material placed on top of the geomembrane liner should be back-dumped on the liner, rather than being pushed across the liner, in an effort to reduce the formation of wrinkles.

#### 4.6.9 Fusion Welding

A fusion welding process shall generally be used for production seams, unless otherwise approved by the Engineer. A fragment strip of geomembrane shall be used beneath the seam area as required where the underling material is too cold, where moisture build-up between the sheets is expected, or to prevent the welding equipment from sticking to the prepared subgrade.

#### 4.6.10 Extrusion Welding

An extrusion welding process shall generally be used primarily for repairs, detailing, capping, unless otherwise approved by the Engineer. The seam to be welded shall be temporarily spot heat bonded before extrusion welding. The temperature of the hot air at the heat nozzle of the heat bonding apparatus shall be controlled such that the geomembrane is not damaged. If non-destructive spark testing will be performed on the seam, a wire is embedded in the weld during the extrusion process.

When welding operations are interrupted, the extrusion welding apparatus shall be purged of heat-degraded extrudate before continuing welding. The restart end of any extrusion weld shall be tapered to a feather edge of not less than 100 mm in length.

#### 4.6.11 Markers

The QC Contractor shall provide sufficient indelible, legible markers (Mean Streak, or other approved) for its own use, and use by the Engineer. A colour convention shall be agreed by all parties.

#### 4.6.12 Seam Properties

All geomembrane seams shall conform to the following requirements:

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### HDPE Geomembrane Seam Properties

Property	ASTM Test Method	Units	Value	
			Fusion Welds	Extrusion Welds
Shear				
Break Strength <sup>1</sup> , min.	D4437	% of PM <sup>2</sup> break strength	100	100
Strain at Break <sup>1</sup> , min.	D4437	% of PM strain at break	50	50
Adhesion	NSF 54	-	FTB <sup>3</sup>	FTB
Peel <sup>4</sup>				
Break Strength <sup>1</sup> , min.	D4437	% of PM break strength	100	100
Incursion, max.	-	% of weld width	10	n/a
Adhesion	NSF 54	-	FTB	FTB
<sup>1</sup> Tests shall be performed at the same strain rate that was used when determining the parent material properties.				
<sup>2</sup> PM = parent material.				
<sup>3</sup> Break shall classify as film-tearing bond (FTB) as defined in NSF Standard 54 Annex A.				
<sup>4</sup> All failures shall be ductile.				

#### 4.6.13 Trial Seams

Before commencing production seaming, trial seams conforming to the requirements in **Error! Reference source not found.** shall be made, and approved by the Engineer, on the same subgrade, under the same operating and environmental conditions, using the same materials, overlap, and seaming techniques, by the same Welding Technician as will be used to fabricate field seams. Trial seams shall be made under the following conditions:

- To prequalify a Welding Technician upon arrival on the Site
- To prequalify a welding apparatus upon arrival on the Site
- Before commencing seaming operations at the start of a shift
- Before commencing seaming operations after the mid-shift break
- After every four hours of seaming operation
- When a different Welding Technician starts seaming
- When a welding apparatus is restarted after repair or adjustment
- After a welding apparatus is stopped for 30 minutes or more
- When there is a substantial change in environmental conditions
- At the sole discretion of the QC Contractor or the Engineer

Fusion weld trial seams shall be a minimum of 3,0 metres long by 300 mm wide after seaming, with the seam centred lengthwise. Extrusion weld trial seams shall be a minimum of 1,0 metre long by 300 mm wide after seaming, with the seam centred lengthwise. All trial seams shall be labelled by the Welding Technician, who shall record pertinent details relative to the weld, including:

- Welding Technician's initials
- Welding apparatus identification number
- Welding apparatus temperatures
- Ambient temperature measured 150 mm above the geomembrane
- Date and time welding of the seam commenced

The seam shall be allowed to cool naturally to ambient temperature before performing destructive testing described in **Error! Reference source not found.** Failure of the trial seam to meet the specified requirements shall require the Master Seamer to establish the cause of the failure, take corrective action, and repeat the trial seam procedure. If the second trial seam fails, the Welding Technician and welding apparatus shall not be allowed to perform field seams until the deficiencies are corrected, and two consecutive passing trial seams are achieved.

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The QC Contractor shall monitor the pass/fail ratio of trial seams with respect to geomembrane material, Welding Technician and welding apparatus, and the results shall be reported daily to the Engineer.

#### 4.6.14 Field Seams

The Welding Technician shall prepare the area to be welded, and continuously monitor the seaming operation and maintain the specified overlap. The welding apparatus temperature shall be monitored, and the information marked on the geomembrane periodically.

Seaming shall extend to the outside edge of geomembrane to be placed in trenches. No fish mouths shall be allowed within the seam area, and if fish mouths occur, the material shall be cut, overlapped, and extrusion welded. No seams shall be left unwelded and no openings in the geomembrane shall be left at the end of a shift, without approval from the Engineer.

All field seams shall be labelled by the Welding Technician according to the identification code on the panel layout, who shall record pertinent details relative to the weld, including:

- Welding Technician's initials
- Welding apparatus identification number
- Set temperature for fusion welders or nozzle temperature and preheat temperature for extrusion welders
- Ambient temperature measured 150 mm above the geomembrane
- Date and time welding of the seam commenced

The seam shall be allowed to cool naturally to ambient temperature before performing destructive testing described in **Error! Reference source not found..** Failure of the field seam to meet the specified requirements shall require the Master Seamer to follow the procedure described in **Error! Reference source not found.**, and to withdraw the welding apparatus from service until a passing trial weld is obtained.

The QC Contractor shall monitor the pass/fail ratio of field seams with respect to geomembrane material, Welding Technician and welding apparatus, and the results shall be reported daily to the Engineer.

#### 4.6.15 Non-Destructive Seam Testing

Inspections and non-destructive tests shall be performed on the full length of all seams and repairs using air pressure, vacuum, water, spark, or other approved method. Inter-seam air-pressure tests shall be performed to test continuity on seams with an enclosed air space. Vacuum testing shall be performed to test continuity on seams that cannot be tested with air pressure due to the absence of an enclosed air space. Hydrostatic or spark testing shall be conducted on seams used to make pipe boots and other prefabricated pieces. In locations where seams cannot be non-destructively tested, the area shall be capped, if possible, as instructed by the Engineer. Seams that are accessible for testing prior to final installation of the geomembrane or prefabricated piece shall be tested before final installation.

Non-destructive testing shall be performed by the QC Contractor as the seaming progresses, and in no case shall it be undertaken more than 24 hours after the seam was made. The QC Contractor shall monitor the pass/fail ratio of non-destructive tests with respect to test type, geomembrane material, Welding Technician and welding apparatus, and the results shall be reported daily to the Engineer.

The non-destructive testing program shall include:

#### 4.6.16 Observation

Visual observations shall be made routinely and shall include the following:

- Visually check of field seams for squeeze out, foot print, melt and overlap
- Check machines for cleanliness, temperature, and related items

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#### 4.6.17 Inter-Seam Air-Pressure Testing (Pressure Testing)

Pressure testing equipment shall be capable of generating and sustaining an air pressure up to 275 kPa. The pressure test shall be performed according to the following procedure:

- Seal both ends of the seam to be tested.
- Insert a pressure gauge/needle assembly into the inter-seam void. Pressure test locations shall be at the extreme ends of the seams, and positioned in anchor trenches or at other non-critical locations.
- Apply an initial air pressure to the inter-seam void according to the following schedule. The initial air pressure shall be recorded after a 2-minute period to allow the air pressure and temperature to stabilize.

##### Polyethylene Geomembrane Inter-Seam Pressure Schedule

Nominal Geomembrane Thickness	Initial Pressure, Range		Maximum Difference Between Initial and Final Pressure
	Minimum	Maximum	
1.0 mm	165 kPa	200 kPa	28 kPa
1.5 mm	185 kPa	220 kPa	20 kPa
2.0 mm	205 kPa	240 kPa	14 kPa
2.5 mm	205 kPa	240 kPa	14 kPa

- Five minutes after recording the initial pressure, the final pressure shall be recorded. If the difference between the initial and final pressure reading is more than the allowable difference contained in the above table, or the pressure does not stabilize, the seam shall fail. The location of the leak shall be found and repaired as described in **Error! Reference source not found.**, and the entire seam retested.
- Record details relative to the pressure test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date
  - Initial pressure and time
  - Final pressure and time
  - Pass/fail designation
- After the test is completed and with the pressure still applied, the end of the seam furthest from the pressure gauge shall be cut open to observe the presence of escaping air which serves to confirm the inter-seam channel is continuous. Alternatively, pressure gauges may be used at both ends of the seam during the test. If air does not escape, the blockage in the channel shall be located, and a pressure test performed on the untested part of the seam.
- Seal the penetration holes made by the pressure gauge/needle assembly by extrusion welding.

#### 4.6.18 Vacuum Testing

Vacuum testing equipment shall be capable of generating and sustaining a negative pressure of at least 34 kPa, or 250 mm of mercury, and is fitted with a translucent viewing window for observing the test. Vacuum testing equipment of various sizes and configurations shall be provided to test seams in all locations. The vacuum test shall be performed according to the following procedure:

- Trim excess overlap, if any, from the seam.
- Apply a generous amount of a strong solution of liquid detergent and water to the area to be tested.
- Place the vacuum box over the area and apply a slight amount of downward pressure to the box to seat the seal strip to the geomembrane.

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- Apply a vacuum of at least 34 kPa to the area for a minimum of 10 seconds, and observe the seam through the viewing window for the presence of soap bubbles emitted from the seam. If no bubbles are observed, reposition the box over the next area to be tested with an overlap of at least 75 mm. If bubbles are observed, the area tested shall fail. The location of the leak shall be marked, repaired as described in **Error! Reference source not found.**, and retested.
- Record details relative to the vacuum test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date and time of test
  - Pass/fail designation

#### 4.6.19 Spark Testing

Spark test must be performed on all extrusion welds. To perform the spark testing of extrusion welds, a 1,22-mm-diameter bare copper or stainless steel wire is embedded in the weld close to the overlap during the extrusion process. One end of the wire is left exposed and grounded. The spark test shall be performed according to the following procedure:

- Hold the electrode of the spark tester near the grounding source and set the voltage to a level that will enable the unit to generate a spark at least 1,5 to 2,0 times and the length of the longest anticipated leak path. (This is typically the distance from the wire to the outer edge of the weld bead.)
- Run the testing electrode along the length of the seam while maintaining contact between the electrode and the seam/membrane ensuring that the spark gap does not become too great for the voltage setting. If a spark is observed, the area tested shall fail. The location of the spark shall be marked, repaired as described in **Error! Reference source not found.**, and retested.
- Record details relative to the spark test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date and time of test
  - Voltage setting
  - Pass/fail designation

#### 4.6.20 Hydrostatic Testing

Hydrostatic testing shall be performed according to the following procedure after completion of welding of pipe boots and other prefabricated pieces:

- Raise and the perimeter of the piece at a height that will form a basin and allow the weld to be seen from below. The elevation of the perimeter shall be at least 200 mm higher than the weld to be tested.
- Slowly add sufficient water to the basin that is formed to submerge the weld being tested at least 100 mm.
- Monitor the weld for a period of at least 15 minutes. If a leak is observed, the weld tested shall fail. The location of the leak shall be marked, repaired as described in **Error! Reference source not found.**, and retested.
- The water shall be added and removed from the basin in such a manner that does not cause damage to the surrounding geomembrane or subgrade.
- Record details relative to the hydrostatic test in an area that will be visible after the piece is installed, including:
  - Tester's initials

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- Date and time of test
- Pass/fail designation

#### 4.6.21 Destructive Seam Testing

Destructive tests shall be performed on samples cut from trial and field seams. Field seam samples shall be taken at a frequency not less than one sample per 100 metres, at locations identified by the Engineer. Destructive testing shall be performed by the QC Contractor as the seaming progresses, and in no case shall it be undertaken more than 24 hours after the test location has been marked by the Engineer. The QC Contractor shall monitor the pass/fail ratio of non-destructive tests with respect to test type, geomembrane material, Welding Technician and welding apparatus, and the results shall be reported daily to the Engineer.

Destructive test samples shall be a minimum of 600 mm long by 300 mm wide, with the seam centred lengthwise. The sample shall be cut into two 300 mm long pieces, with one piece used by the QC Contractor (QC Sample) for destructive testing as described and the other piece retained by the Engineer. An additional 300 mm by 300 mm sample may be cut, if requested by the Engineer, for independent laboratory testing. The sample shall be marked with a sample identification number, the seam number, and date and time. The QC Contractor shall accurately mark the sample location and sample identification number on the panel layout drawing.

The destructive test shall be performed according to the following procedure:

- Cut 10 coupon specimens from the QC Contractor's sample using a coupon cutter and die.
- Test and examine 5 coupons for conformance to the shear requirements contained in **Error! Reference source not found..** If any of the test results for any of the coupons fail to conform, the seam shall fail. In the event of a failure, the procedure outlined below shall be followed.
- Test and examine 5 coupons for conformance to the peel requirements contained in **Error! Reference source not found..** Seams with enclosed air space shall have each weld tested in peel. If any of the test results for any of the coupons fail to conform, the seam shall fail. In the event of a failure, the procedure outlined below shall be followed.
- Record details relative to the destructive test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date and time sample taken
  - Pass/fail designation.
- Repair the area where the sample was taken.

The procedure outlined below shall be followed when there is a destructive test failure:

- Perform two additional destructive seam tests according the procedure outlined above, one on each side of the failed test location, and at least 3.0 metres from the failed test. If either of the additional tests fails, additional samples shall be taken in accordance with the above procedure until two passing tests are achieved to establish a zone in which the seam shall be repaired as described in **Error! Reference source not found..** In lieu of taking an excessive number of samples, with the approval of the Engineer, the entire seam may be repaired.
- Record details relative to the destructive test on the geomembrane at the test location or on a portion of the seam tested, including:
  - Tester's initials
  - Date and time sample taken
  - Pass/fail designation.

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#### 4.6.22 Verification of Repairs

Repairs shall be non-destructively tested according to **Error! Reference source not found.** In cases where the repaired seam exceeds 50 metres in length, the Engineer may require that a destructive test be performed according to **Error! Reference source not found.** from within the zone in which the seam was repaired. Repairs that fail the tests shall be repaired and retested until a passing test result is obtained.

### 4.7 Repairs

#### 4.7.1 General

Any portion of the geomembrane or seam showing a defect, or having a failed destructive or non-destructive test shall be repaired. Reasons for requiring repairs to the geomembrane installation include, but are not limited to:

- A failed non-destructive seam test
- A destructive seam test
- Seam intersections
- A hole, tear, or penetration, including holes in the seam for air pressure testing device
- A scratch, gouge, or nick that penetrates more than 10 percent of the material thickness
- A hard object underneath the geomembrane
- A fish mouth or wrinkle at seam overlaps
- Insufficient overlap
- Bridging
- Excessive scuffing
- Geomembrane material defects
- Large wrinkles

Panels that require more than one repair per 25 m<sup>2</sup> shall, if instructed by the Engineer, be removed and replaced with new geomembrane at the Contractor's expense.

All repairs shall be labeled by the Welding Technician, who shall record pertinent details relative to the weld, including:

- Welding Technician's initials
- Welding apparatus identification number
- Set temperature for fusion welders or nozzle temperature and preheat temperature for extrusion welders
- Ambient temperature measured 150 mm above the geomembrane
- Date and time welding of the repair commenced

#### 4.7.2 Repair Methods

Agreement on the appropriate repair and welding method shall be reached between the Contractor and the Engineer. The seams used to make repairs shall conform to the requirements of **Error! Reference source not found.** Repairs shall be undertaken using one or a combination of the following methods:

#### 4.7.3 Patching

Used to repair large holes or tears, destructive test locations, fish mouths, wrinkles, seam intersections, insufficient overlap, bridging, and geomembrane material defects.

Fish mouths and wrinkles shall be cut along the ridge of the wrinkle to achieve a flat overlap. The cut shall be extrusion welded before applying a patch. Where there is a hard object underneath the geomembrane, the geomembrane shall be cut, the object removed, and the hole patched. If the object is thought to be a lump of soil that can be broken up

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with the heel of a boot, the geomembrane need not be cut. The resulting stress point or hole shall be patched or spot welded as required by the Engineer.

Patching shall comprise installing a new piece of geomembrane of the same material type and thickness over the area to be repaired, and welding it to the underlying geomembrane by extrusion welding. Patches shall be large enough to extend a minimum of 150 mm beyond the limits of the area being repaired, and shall have smoothly rounded corners with a radius exceeding 150 mm.

No patches shall overlap. If this is required to make a repair, the entire area, including all previous patches in the near vicinity, shall be covered with a single large patch. Deviations from this requirement shall be approved by the Engineer.

#### 4.7.4 Grinding and Rewelding

Used to repair small sections of seams made with extrusion welds.

The length of weld to be repaired shall be abraded without removing more than 10 percent of the geomembrane thickness before rewelding the seam.

#### 4.7.5 Spot Welding

Used to repair a scratch, gouge, or nick that penetrates more than 10 percent of the material thickness, but does not fully penetrate the geomembrane. An exception is a pinhole or a hole made by the pressure testing device.

The spot to be repaired shall be abraded without removing more than 10 percent of the geomembrane thickness before applying an extrudate bead.

#### 4.7.6 Capping

Used to repair long failed seams, or a series of destructive test sample holes.

Patching shall comprise installing a new piece of geomembrane of the same material type and thickness over the area to be repaired, and welding it to the underlying geomembrane by fusion or extrusion welding. If fusion welding is approved by the Engineer, a hole may be cut in the geomembrane for inserting the welding apparatus. The insertion hole shall be patched. The cap shall be large enough to extend a minimum of 600 mm beyond the end of the failed seam, and shall have a minimum width of 900 mm. Any cap that is wider than 1,5 metres shall be considered a new panel and shall be shown on the panel layout drawing.

#### 4.7.7 Seam Replacement

Used to repair long failed seams in lieu of capping, with approval of the Engineer.

Seam replacement shall be performed by removing the failed seam and a 1,5 metres wide strip of geomembrane. A new strip of geomembrane of the same material type and thickness shall be inserted and welded to the adjacent geomembrane by fusion welding. The replaced material shall be considered a new panel and shall be shown on the panel layout drawing.

#### 4.7.8 Flap Welding

Used to repair long failed seams in lieu of capping, and may only be used in limited circumstances, with prior approval of the Engineer.

Flap welding shall be performed by welding the seam overlap flap of the failed seam to the underlying geomembrane by extrusion welding.

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#### 4.7.9 Seam Reconstruction

Used to repair long failed seams in lieu of capping, and may only be used in limited circumstances, with prior approval of the Engineer.

Seam reconstruction shall be performed by removing the failed seam and the minimum possible strip of geomembrane. The remaining geomembrane shall then be pulled together and seamed using fusion welding. The Contractor shall demonstrate to the satisfaction Engineer that pulling the panels will not cause damage to the geomembrane or any other portion of the installation.

#### 4.7.10 Large Wrinkles

When seaming of the geomembrane is completed (or when seaming of a large area of the geomembranes is completed) and prior to placing overlying materials, The CQA officer will observe the sizes and distribution of geomembrane wrinkles. The CQA officer will discuss with the Engineer which wrinkles should be cut and re-seamed by the Installer at his cost. The seam thus produced will be tested like any other seam.

The wrinkle height to width ratio for the installed geomembrane shall not exceed 0.5. In addition, geomembrane wrinkles shall not exceed 100mm in height. Wrinkles that do not meet the above criteria shall be cut out and repaired in accordance with the Installer's approved QC manual.

#### 4.7.11 Bridging of Geomembrane

Bridging or trampolining of the geomembrane at any temperature higher than the design minimum service temperature or higher than the expected covering temperature at any location at any time shall be considered unacceptable. Compensating material will be installed at these locations. The geomembrane must be fully supported by the subgrade at the time of covering with liquid or soil. The minimum service temperature includes any period (after acceptance of the installation by the owner) when the liner is uncovered even though final service may involve covering the liner.

### 4.8 Anchor Trench Backfill

Prior to backfilling termination or anchor trenches, the Contractor shall inspect, with the earthworks contractor, QC Contractor and Engineer, all trenches to be backfilled, and the Contractor shall certify in writing that the trench is ready to be backfilled. The responsibility for maintenance of the accepted trench is described in the Project Specification.

Sandbags used to ballast the geosynthetics shall be removed by the geosynthetics contractor from the trench during backfilling at a rate commensurate with backfilling so that the geosynthetics do not pull out of the trench.

### 4.9 Wear Sheets

Where shown on the Drawings, or required by the Engineer, the Contractor shall install wear sheets of material type and thickness specified. Prior to installing wear sheets, the underlying geomembrane shall be tested and approved, and cleaned to remove any objects that may damage the geomembrane. The wear sheet shall be tacked the underlying geomembrane by extrusion welds of length and spacing shown on the Drawings. If no length or spacing is specified, tack welds shall be a minimum of 500 mm long on minimum 3-metre centres. Testing of the seams is not required.

### 4.10 Cover Material

The cover materials shall be compatible as well as suitable for use over the geomembrane and placed in a manner appropriate to the particular subgrade. Regardless of the cover material, the uncovered edge of geomembrane panels shall be protected at the end of the working day with a waterproof sheet, which is adequately secured with ballasts.

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#### 4.10.1 Protection Geosynthetic

Precaution shall be taken to prevent damage to the geomembrane by restricting the use of heavy equipment over the liner system. Installation of the overlying geosynthetic component (protection geotextile or geogrid) shall be done either using manual labour or lightweight, rubber-tyred equipment such as a 4-wheel all terrain vehicle (ATV). This vehicle can be driven directly on the geomembrane, provided the ATV makes no sudden stops, starts or turns. If such occurrences do occur, the CQA officer shall be notified immediately. The CQA officer will then inspect the possible damage and may instruct a repair in accordance with Item 4.7. No other mechanical plant shall ride on the geomembrane.

Smooth HDPE sheets may be dragged across the geomembrane surface with equipment or by hand labour during position. Similarly, the HDPE may be unrolled with the use of low ground pressure equipment.

#### 4.10.2 Earth Cover (to be executed by the main earthworks contractor)

A minimum thickness of 250 mm (or as indicated on the drawings) of clean, selected sand (approved by the CQA officer) shall be placed over the geomembrane and protection geotextile (as indicated on the drawings). The soil shall be free of sharp-edged stones greater than 10mm in size.

Soil cover shall only be placed when the liner temperature is less than 45° C and it shall be placed with low ground pressure equipment. This may require that the soil cover be placed only during the cool part of the day or at night. Care shall be taken to avoid damaging the geomembrane or geotextile by making sharp turns or pivots with equipment as well as sudden starts or stops.

Soils may be placed on the geomembrane by pushing with a track-dozzer or by carefully placing it with a loader or a backhoe. The use of construction machinery directly over the geomembrane is strictly prohibited. A minimum thickness of 250 mm of cover shall be kept between heavy equipment and geomembrane at all times, except when final-grading. No heavy vehicles may be driven directly over the geomembrane until the proper thickness of cover has been placed.

Wrinkles in the geomembrane shall be prevented from folding over during the placement of cover material.

To prevent damage to the geomembrane, the initial lift(s) of soil cover shall not be compacted more than 85% of modified AASHTO density or as specified by the Engineer. Cover soil shall not be dropped from a height greater than 1m.

When covering geomembrane on sloped areas, cover shall be pushed up-slope to minimize tension on the geomembrane.

#### 4.11 Installation Warranty

Upon completion of the installation and testing program, and acceptance of the installation by the Owner, the Contractor shall provide a warrant of the quality of the geomembrane installation, and that the installation will not fail for a minimum period of 10 (ten) years from date of acceptance of installation. The warranty shall cover the cost of material, labour and equipment to replace the failed installation.

### 5) TOLERANCES

The Works shall be finished to the Degree of Accuracy given in the Project Specifications, and the permissible deviations (PD) shall be within the limits given below for the Degree of Accuracy specified.

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**Witness:** .....

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Initial: MCM .....





**Permissible Deviation (PD)**

	Degree of Accuracy		
	III	II	I
1. Geomembrane Overlap	2 0 mm	2 0 mm	2 0 mm

**6) DOCUMENTATION****6.1 General**

An effective CQA plan depends largely on recognition of all construction activities that must be monitored, and on assigning responsibilities for the monitoring of each activity. This is most effectively accomplished and verified by the documentation of quality assurance activities. The Engineer will ensure that all quality assurance requirements have been addressed and satisfied.

**6.2 Daily Record keeping**

Standard reporting procedures shall include preparation of daily reports that, at a minimum, will consist of:

- Field notes, including memoranda of meetings and/or discussions with the Contractor and GSM Installer.
- Observation logs and testing data sheets.
- Construction problem and solution data sheets.

This information must be regularly submitted to, and reviewed by the Engineer.

**6.3 Observation Logs and Testing Data Sheets**

Observation logs and testing data sheets shall be prepared daily. At a minimum, these logs and data sheets shall include the following information:

- An identifying log/sheet number of cross-referencing and document control
- Date, client name, project name, location and other identification
- Data on weather conditions
- A site plan showing all active work areas and test locations
- Descriptions and locations of on-going construction
- Equipment and personnel in each work area, including those of all related subcontractors
- Description and specific locations of areas, or units, of work being tested and/or observed and documented
- Locations where tests were undertaken and samples taken
- A summary of test results
- Calibrations of test equipment and actions taken as a result of any non-conformance
- Off-site materials received, including quality verification documentation
- Decisions made regarding acceptance of units of work and/or corrective actions to be taken in instances of non-conformance
- Signatures of CQA officer and CQC monitor

These logs must show all non-complying test results.

A comprehensive set of CQA logs shall be as follows:

- Manufacturer/GCL Installer Compliance Agreement
- Daily personnel attendance list
- Material inventory
- Conformance testing

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- Subgrade acceptance
- Material deployment
- Trial Seaming
- Production seaming
- Repairs
- Non-destructive testing
- Destructive testing
- Laboratory test results
- Problems and Solutions
- Soil Cover placement
- Daily report

These documents shall provide fully traceable record of men, machines, machine settings, materials, and weather and test results, in the event of in-service operational problems.  
The CQA Officer shall incorporate all these logs in the CQA Final Report.

## 6.4 CQA Final Report

### 6.4.1 Submission of report

The CQA Final Report will be submitted by the Engineer to the Employer within 40 days of completion of installation of the lining system.

### CQA Final Report Contents

At a minimum the CQA Final Report shall contain the following information:

- An outline of the project
- A description of the lining system
- Reference to the CQA Plan and other documents used
- Geosynthetic membrane and other geosynthetic materials specifications
- A summary of on-site CQA activities and quantities (samples, failing results)
- A photographic record of construction
- Manufacturer/Geomembrane Installer Compliance Agreement
- Subgrade acceptance certificates
- Copies of all logs
- All test results
- Discussion of problems and solutions
- Record drawings
- Certificate statement

### Record/As Built Drawings

The record drawings must show:

- The location of all geomembrane joints and the types of joints
- Geomembrane panel and roll numbers and geomembrane type
- The location of all geomembrane repairs and the types of repairs
- Toes of slopes
- Crests of slopes
- Location of anchor trenches
- Location and numbers of any geomembrane destructive test sample sites
- Construction details that differ from as-designed details

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## 7) MEASUREMENT AND PAYMENT

### 7.1 Measurement

Quantities for payment will be measured to finished shapes, sections, and profiles as shown on the Drawings will be included in the measurements unless performed on the written instruction of the Engineer.

Final quantities for the payment will be determined by the Engineer from the pre-construction, intermediate, and post-construction surveys and the approved as-built drawings. The Contractor shall provide all personnel, equipment and materials required to make such surveys, measurements, and other computations as are necessary to determine all estimates of monthly and final payments for Work performed, or as requested from time to time by the Engineer. A copy of the survey data and calculations shall be provided to the Engineer. Failure on the part of the Contractor to submit its survey data to the Engineer before commencing work will be held to indicate that it is prepared to accept the volume provided by the Engineer for the purposes of measurement and payment.

The Engineer may conduct such checks on the Contractor's survey, measurements and calculations, as he considers necessary, to confirm their adequacy and accuracy. Any discrepancies in the survey data identified by the Engineer shall be resolved with the Contractor before the Contractor may proceed with Work in that area. In the event of such failure, no subsequent claim in this regard will be considered. The Contractor shall allow in its construction schedule for the Engineer to check the surveys, measurements and computations.

#### 7.1.1 Length

The measurement of length will be made along the centreline, adjusted for slope.

#### 7.1.2 Area

Unless geomembrane is deployed in simple geometric forms, area will be computed using a planimeter, survey methods, or other means as determined by the Engineer. The plan area measured will be adjusted for slope.

Measurement will not be made of geosynthetic waste, overlaps, patches, or scrap unless otherwise approved by the Engineer. Geosynthetics placed in trenches will be measured according to the embedded length shown on the Drawings multiplied by the length of the trench.

### 7.2 Payment

Items listed in the Schedule of Rates and Prices are deemed to cover all work indicated in the Drawings or detailed in the Contract. No additional items may be claimed by the Contractor and the Contractor must allow in the unit rates and prices for completing the Works in their entirety.

Notwithstanding the above, the Contractor declares that every unit rate and price submitted in the Schedule of Rates and Prices has been derived in a reasonable fashion and properly reflects the cost of doing the portion of the Work to which that unit rate or price pertains.

### 7.3 Listed Payment Items

Supply geomembrane .....(m<sup>2</sup>)

Separate items will be listed for each structure or work area and for each geomembrane type and thickness. The rate shall cover the cost of material and consumables (such as welding rods/beads), delivery to and offloading at the Site.

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Install geomembrane .....(m<sup>2</sup>)

Separate items will be listed for each structure or work area and for each geomembrane type and thickness. The rate shall cover the cost of storage, handling, and loading and transporting from the storage area to the work area, protecting the prepared subgrade, deployment, consumables (such as sandbags), and seaming.

Install wear sheet .....(m<sup>2</sup>)

Separate items will be listed for each structure or work area and for each geomembrane type and thickness. The rate shall cover the cost of deployment, seaming, and tack welding to underlying geomembrane.

Fabricate and install pipe boots .....(No.)

Separate items will be listed for each structure or work area and for each geomembrane type and thickness, and pipe diameter. The rate shall cover the cost of fabrication and installation, including clamps, bands, gaskets, etc.

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**Initial:** MCM .....



## **PART C4 SITE INFORMATION**

Refer to Part C3, specification section 3 for existing site facilities available for use and maintenance by the Contractor.

### **1 NATURE OF WASTE, GROUND AND SUBSOIL CONDITIONS**

The area of concern is located in a municipal solid waste landfill disposal area. The site is located against a weathered granite hill slope. The area of concern is furthermore generally dry but may be affected by runoff during rain events as the water will run through the damaged areas.

This contract predominantly covers two aspects of the landfill facility.

The first aspect is the repair of an existing landfill geomembrane liner system. The liner system consists of:

- (a) a prepared weathered granite base at the bottom
- (b) a geotextile layer on top of the soil
- (c) a 1,5mm geomembrane liner on top of the geotextile
- (d) a nominal 300mm stone drainage layer on top of the liner.

Due to ongoing daily operation and maintenance of the landfill facility the liner was damaged by heavy machinery. The damaged areas are located to one side of the landfill and can thus be attended to while normal operations continue. The heavy machinery have essentially cut and lifted both components of the liner (geotextile and geomembrane) which are exposed. Damage has occurred essentially in two areas against the rear eastern slope of the landfill.

The second aspect is the replacing of the leachate pond liner. The liner has suffered mechanical damage (fire cinders, cuts, inferior workmanship etc.).

The MCM wishes to proceed with the landfill of waste but due to the damaged areas have had to divert waste elsewhere on the landfill. Additional areas can be identified while attending to the damage liner described above.

The damaged liner will be repaired to some extent and a new geomembrane layer is to be installed over the old liner with a new cusped leakage detection layer in between.

PPE will be required and health and safety measures as described in Annexure "A" will be adhered to. Cognisance has to be taken that the work to be undertaken is on an active landfill. Special care has to be exercised especially with the potential presence of landfill gas and heavy machinery.

The attached drawing will show the location of the site and the location of the proposed works area within the landfill cell.

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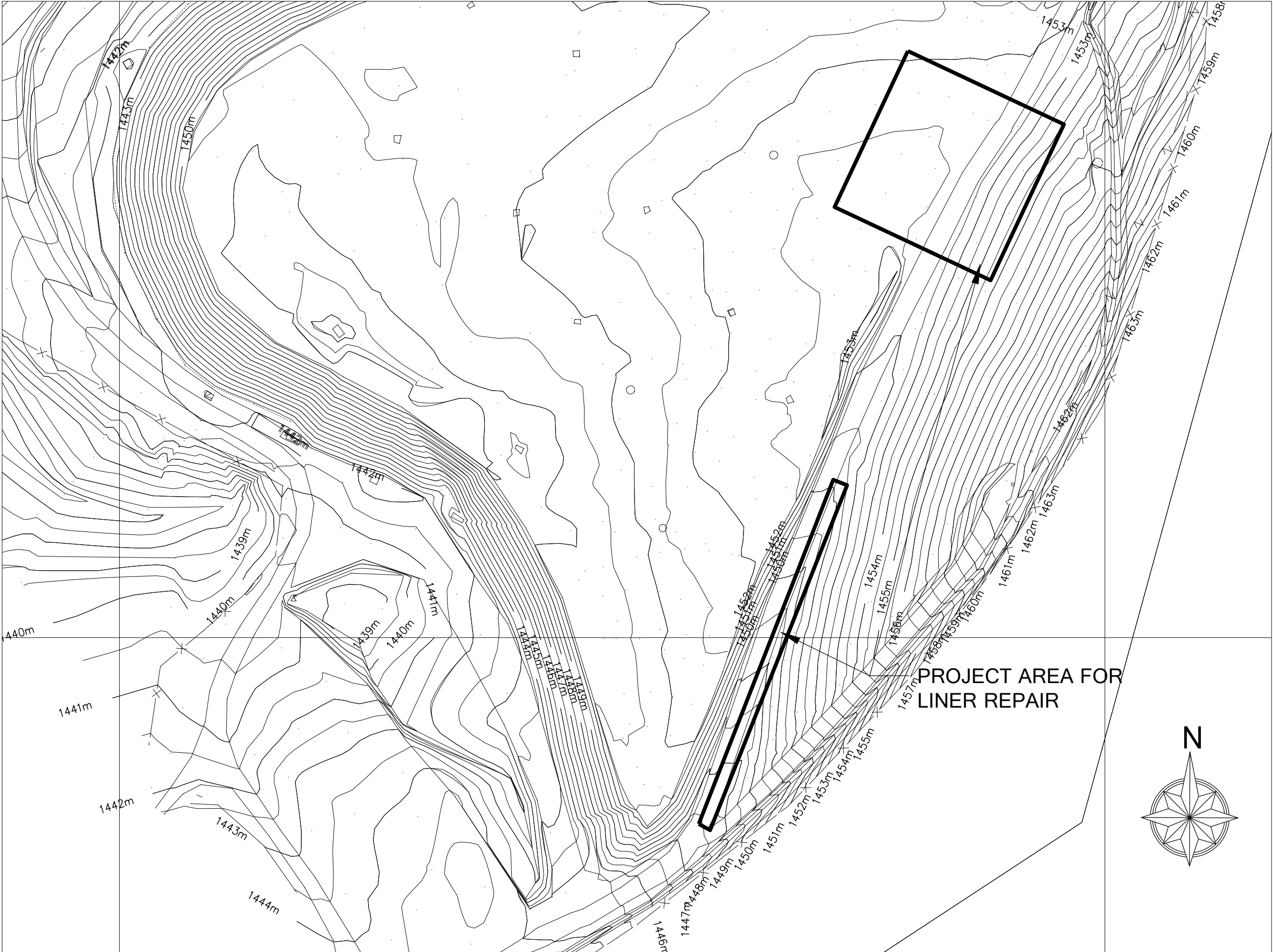
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**MCM:**

**Initial:** MCM .....





NOTES:

DEPARTMENT ENGINEER

NAME:  
PR ENG NO:

CONSULTING ENGINEER

NAME:  
PR ENG NO:

C	09.07.2019	ISSUED FOR TENDER
B	27.07.2018	ISSUED FOR APPROVAL
A	07.04.2018	ISSUED FOR APPROVAL
NO	DATE	DESCRIPTION



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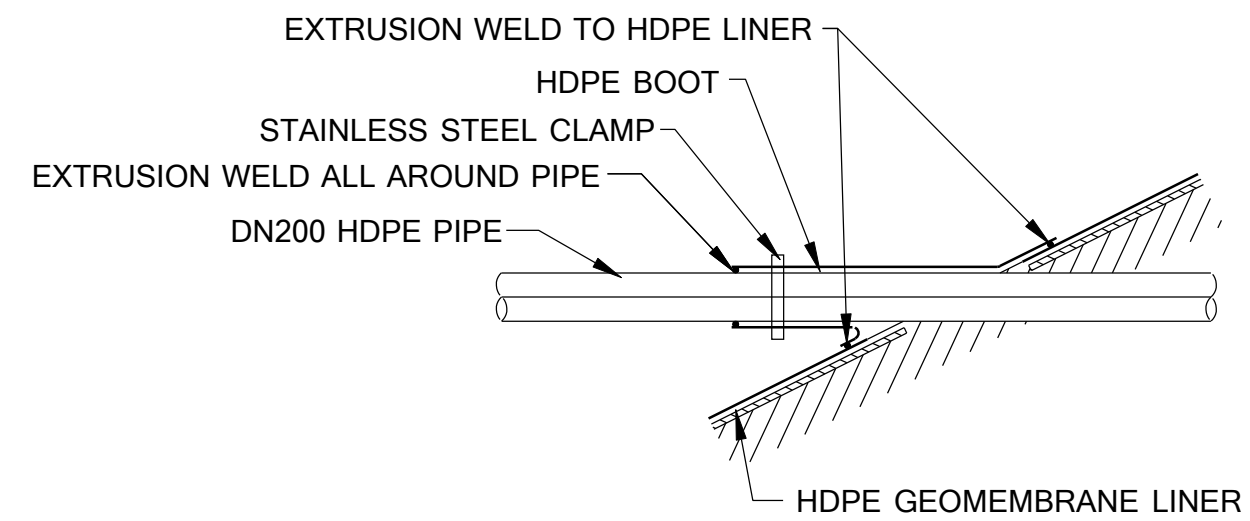
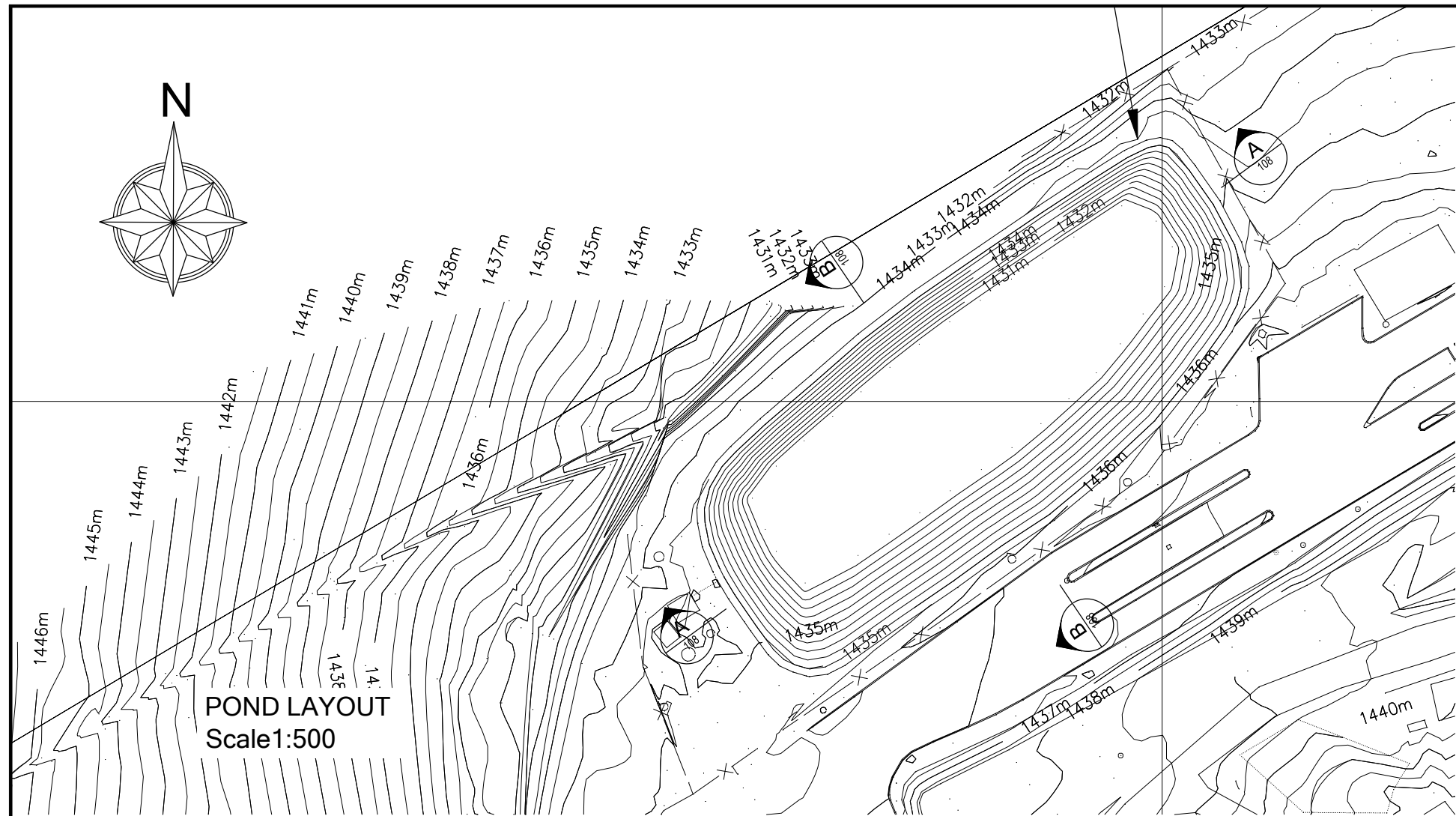
PROJECT  
MBABANE SANITARY LANDFILL

DRAWING TITLE  
LINER REPAIRATIONS

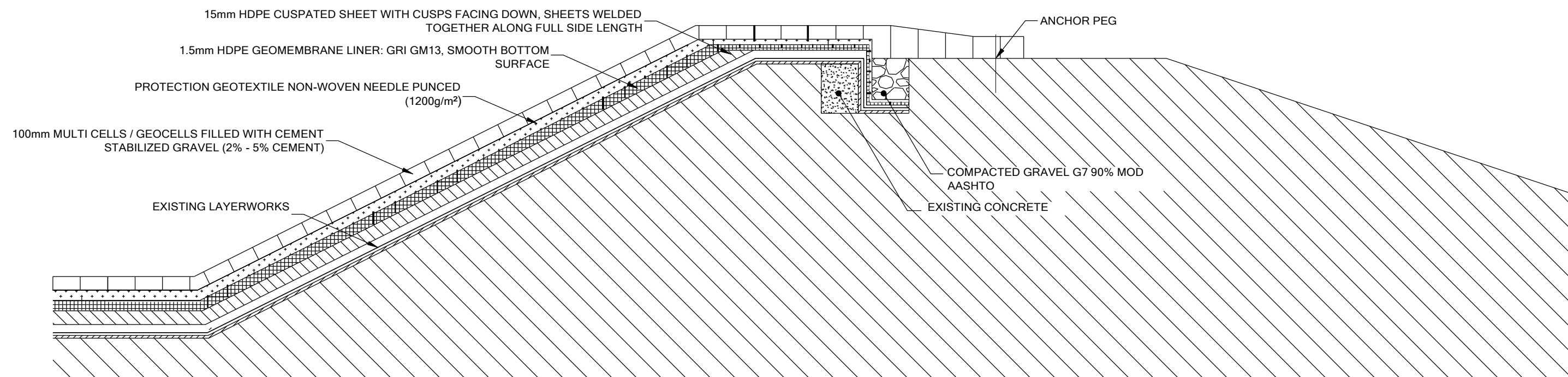
DATE 09.07.2019	SCALE 1:500	DRAWN M. PAPADOPOULOS
DESIGNED P.SMUTS	CHECKED P.SMUTS	REVISION NO. C

DRWG NO. 1103-CIV-121 FOR TENDER

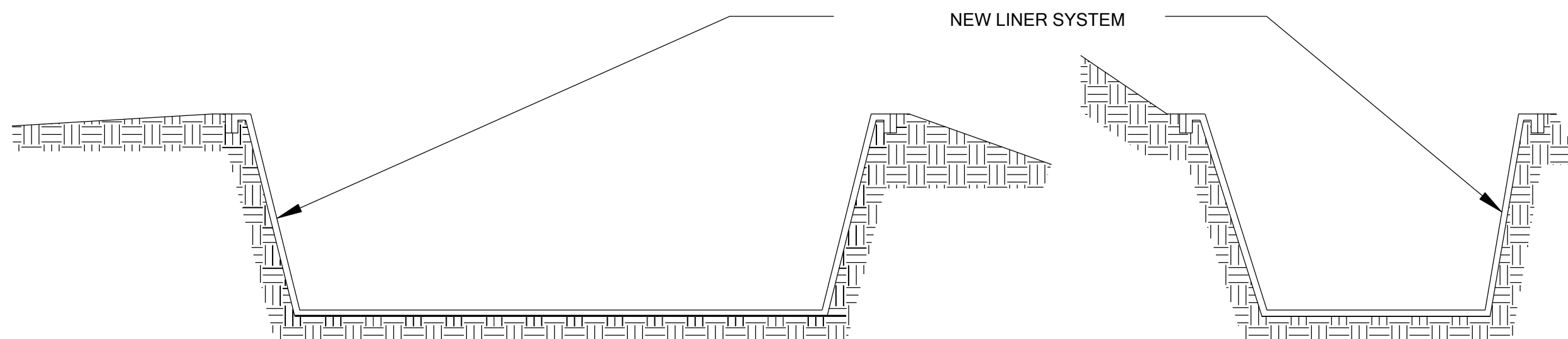




TYPICAL LINER PENETRATION  
DETAIL  
SCALE 1:20



TYPICAL SECTION THROUGH LEACHATE POND WALL  
SCALE 1:20



SECTION A  
SCALE 1:20  
108



SECTION B  
SCALE 1:20  
108

NOTES:

DEPARTMENT ENGINEER

NAME:

PR ENG NO:

CONSULTING ENGINEER

NAME:

PR ENG NO:


C 09.07.2019 ISSUED FOR TENDER

B 27.07.2018 ISSUED FOR APPROVAL

A 07.04.2018 ISSUED FOR APPROVAL

NO DATE DESCRIPTION

CLIENT



MUNICIPAL COUNCIL OF MBABANE

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PROJECT

MBABANE SANITARY LANDFILL

DRAWING TITLE

POND REPAIRATIONS

DATE 09.07.2019	SCALE AS SHOWN	DRAWN M. PAPADOPOULOS
DESIGNED P.SMUTS	CHECKED P.SMUTS	REVISION NO. C

DRWG NO. 1103-CIV-119 FOR TENDER