



VOLUME - 1

TECHNICAL BID DOCUMENT

AHMEDABAD MUNICIPAL CORPORATION (AMC), SWM DEPARTMENT

CONSTRUCTION OF SECURED LANDFILL PHASE 2 AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD FOR DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTE

**RE-INVITE TENDER DOCUMENT
FOR THE CONSTRUCTION OF PHASE – 2
OF THE SECURED ENGINEERED MUNICIPAL SOLID WASTE
LANDFILL SITE FOR
DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTES
OF AHMEDABAD MUNICIPAL CORPORATION
LOCATED AT: SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR,
AHMEDABAD, TALUKA & DISTRICT – AHMEDABAD, GUJARAT, INDIA.**

WORK NO.: AMC/SWM/4/2026-27

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OWNED AND MANAGED BY:

**AHMEDABAD MUNICIPAL CORPORATION, MAHANAGAR SEVA SADAN,
SOLID WASTE MANAGEMENT DEPARTMENT, C – BLOCK, 5TH FLOOR,
SARDAR PATEL BHAVAN, DANAPITH, AHMEDABAD – 380 001,
GUJARAT, INDIA**

JUNE 2026

**VOLUME - 1****TECHNICAL BID DOCUMENT****AHMEDABAD MUNICIPAL CORPORATION (AMC), SWM DEPARTMENT**

CONSTRUCTION OF SECURED LANDFILL PHASE 2 AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD FOR DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTE

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SECTION – 1**RE-INVITE TENDER DETAILS****NAME OF WORK:**

CONSTRUCTION OF PHASE 2 OF SECURED ENGINEERED MUNICIPAL SOLID WASTE LANDFILL SITE FOR DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTES AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD, TALUKA & DIST. AHMEDABAD

PERCENTAGE RATE TENDER AND CONTRACT FOR ALL SCHEDULED WORKS**E- TENDER**

TENDER NOTICE NO: AMC/SWM/4/2026-27

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LAST DATE OF DOWNLOADING OF ONLINE TENDER	From 22/06/2026 to 13/07/2026
WEB SITE	www.amc.nprocure.com/www.tender.nprocure.com
PRE-BID MEETING	29/6/2026, 12:00 Hour At Ahmedabad Municipal Corporation, Additional City Engineer Office, Solid Waste Management Department,
ONLINE QUERY	The bidder who intend to raise their queries can do so through mail adress adcceswm@ahmedabadcity.gov.in or before the Date and time of pre-bid meeting.
LAST DATE OF SUBMISSION OF ONLINE TENDER	UP TO DT. 13/07/2026 up to 18:00 Hour
DATE OF SUBMISSION OF TECHNICAL BID, TENDER FEES, EMD AND OTHER DOCUMENTS IN HARD COPY	Physical submission Last date is UP TO 14/07/2026 Up to 16:00 Hrs at office of The Assistant Manager (Project) Ahmedabad Municipal Corporation, 2nd Floor, Sardar Patel Bhavan, Danapith, Ahmedabad – 380 001. The hard copy of tenders received after this date and time shall not be entertained under any circumstances. Tender shall be submitted in two copies (Original & Duplicate)–INDIA through RPAD/Speed Post/Courier/Hand Delivery AND Financial bid – Volume-2 to be submitted online ONLY.
OPENING OF ONLINE TENDER	Dt. 15/07/2026, 16:00 Hour
ESTIMATED AMOUNT WITHOUT GST	66,96,58,612.52
TENDER FEES	Rs. 18000.00

TO BE SUBMITTED TO:

The Assistant Manager (Project) PWA Office ,AHMEDABAD Municipal Corporation, 2nd Floor, Sardar Patel Bhavan, Danapith, Ahmedabad – 380 001

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SECTION – 2**NOTICE INVITING RE-INVITE TENDER**

CONSTRUCTION OF SECURED LANDFILL PHASE 2 OF AHMEDABAD MUNICIPAL CORPORATION AT SURVEY NO.337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD

Tender Notice No.	AMC/SWM/4/2026-27	
Organization Name	AHMEDABAD MUNICIPAL CORPORATION (AMC)	
Department Name	Solid Waste Management Department	
Name of Work	CONSTRUCTION OF SECURED LANDFILL PHASE 2 OF AHMEDABAD MUNICIPAL CORPORATION AT SURVEY NO.337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD, TALUKA & DISTRICT – AHMEDABAD.	
Tender Type	Open	
Bidder Nationality	INDIAN	
Type of Contract	Work	
Bidding Currency	Single	
Joint Venture	Not Allowed	
Schedule of Tender	Online Query	The bidder who intend to raise their queries can do so through email address addceswm@ahmedabadcity.gov.in on or before the date and time of pre bid meeting.
	Document availability last date & time	On Website Address: www.amc.nprocure.com/www.tender.nprocure.com date for downloading of tender: 13/07/2026
	Last date & time of Bid submission	up toDt. 13/07/2026 up to 18:00 Hours Online only
	Physical submission of EMD, Document Fee, Technical & Financial bid and Supporting documents	Physical submission- 14/07/2026 up to 16:00 Hours at the office of The Assistant Manager (Project) , PWA office, 2nd floor,Ahmedabad Municipal Corporation,Sardar Patel Bhavan, Danapith, Ahmedabad – 380 001 (Gujarat) –INDIA through RPAD/Speed Post/Courier/Hand Delivery. AND Financial bid – volume-2 to be submitted onlineonly
	Opening of Technical Bid	On or After 15/07/2026, 16:00 Hour
	Bid validity period	180 days from opening of bid
	Project Duration	18months(Excl. Monsoon i.e.16 th June-15 th October).
Payment Details	Document Fee	Rs. 18000.00 In form of Demand Draft/Pay Order payable in the favor of AHMEDABAD MUNICIPALCORPORATION – Non Refundable
	EMD	EMDRs. 66,96,590.00 shall have to be paid by Demand Draft/Payorder/Banker's Cheque/Bank Guarantee of any Nationalized Bank/Scheduled Bank payable at Ahmedabad in favour of the Municipal Commissioner, Ahmedabad Municipal Corporation only.
	Estimated Value WO GST	Rs.66,96,58,612.52



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General Terms & Conditions	<p>Bidders who wish to participate in this E-Tender will have to procure valid digital certificate as per Information Technology Act 2000. Bidders can procure this certificate from any of the Government approved certifying agency i.e. (n) Code Solution.</p> <p>Bidders shall upload the tender documents after submitting the DD details for tender fees and EMD details online. The Demand Draft toward Tender Document fees can be submitted along with Earnest Money Deposit before the due date as specified above. This should be as per details given online and it should be drawn before last date of the uploading of the tender. The intending bidders shall have to submit the following documents along with the EMD. The Bidder should submit all the forms electronically only.</p> <ul style="list-style-type: none">(a) Electronic drive containing technical & financial details required for evaluation dully digitally signed.(b) Power of attorney.(c) Company's profile and certificate of registration of company under the law. <p>DOWNLOAD OF TENDER DOCUMENT: -</p> <p>The tender document for these work are available only in Electronic format which can be download free of cost by the bidder.</p> <p>SUBMISSION OF TENDER:-</p> <p>Bidder shall submit their offer in Electronicformat on above mentioned website on or before the scheduled date and time as mentioned, after Digitally Signing the same. No price bid in physical form will be accepted and any such offer if received by Ahmedabad Municipal Corporation will be out rightly rejected. Bidder shall have to submit separate account payee DD for Tender Fee& EMD drawn in favor of The Commissioner, Ahmedabad Municipal Corporation</p>
	<p>OPENING OF TENDER: -</p> <p>The Technical Bid will be opened on the specified date online on website https://amc.nprocure.com Bidders or their representative who wish to participate in online tender opening can log on to https://amc.nprocure.com on the due date and time, mark their presence and participate in online tender opening. Bidders who wish to remain present at Ahmedabad Municipal Corporation, Solid Waste Management Department at the time of tender opening can do so. Only one representative of each firm will be allowed to remain present.</p>

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Information for online participation	<ol style="list-style-type: none">1. Internet site address for e-Tendering activities will be https://amc.nprocure.com2. Interested bidders can view detailed tender notice and download tender documents from the above mentioned website.3. Bidders who wish to participate in online tender have to register with the website through the "New User Registration" link provided on the home page. Bidder will create login id & password on their own in registration process.4. Bidders who wish to participate in this tender need to procure Digital Certificate as per Information Technology Act-2000 using that they can digitally sign their electronic bids. Bidders can procure the same from any of the CCA approved certifying agencies, or they may contact (n) code Solution at below mentioned address and they will assist them in procuring the same. Bidders who already have a valid Digital Certificate need not to procure the same. In case bidders need any clarification regarding online participation, they can contact M/S (n)code Solution 301, G.N.F.C. Info Tower, Near Grand Bhagwati Hotel, Ahmadabad 380015, India. Tel: +91 79 26857316 Tel: +91 79 26857317 Tel: +91 79 26857318 E-Mail: URL: https://amc.nprocure.com5. Bidders who wish to participate in e-Tender need to fill data in predefined forms of tender fee, EMD, PQ (Technical) or experience details and Price bid only.6. Bidder should upload scan copies of reference documents in support of their eligibility of the bid.7. After filling data in predefined forms bidders need to click on final submission link to submit their encrypted bid. Bidder should also submit Document Fees, EMD, Technical bid document & Reference Documents in hard copy if such instructions are given by the tendering authority.8. After filling data in predefined form bidders need to click on final submission link to submit their encrypted bid. Bidder can also submit document fee, EMD, Technical bid document & reference documents in hard copy if such instructions are given by tendering authority.
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**Additional City Engineer, SWM Department
Ahmedabad Municipal Corporation**

**SECTION – 3****GENERAL INFORMATION ABOUT THE RE-INVITE TENDER**

Ahmedabad Municipal Corporation intends to carry out the work of Construction Of Phase 2 Of Secured Engineered Municipal Solid Waste Landfill Site at Gyaspur, Ahmedabad.

Detail of the project is as follow:

Sr. No.	Short Description of the work	Period of completion	Approx. Estimated cost (Rs.)
1	Construction Of Phase 2 Of Secured Engineered Municipal Solid Waste Landfill Site at Gyaspur, Ahmedabad	18 Months (Excluding Monsoon i.e. 16 th June to 15 th October).	Rs.66,96,58,612.52

1. Substantially completed work shall mean which are at least 90% completed as on the date of submission and continuing satisfactorily on date of application.
2. All the information shall have to be filled in the prescribed statement wherever mentioned.
3. All the details required in the prescribed statement shall have to be duly filled up. No information shall be left out. Relevant item without required information shall not be considered for evaluation.
4. All the required attachments shall have to be invariably attached. Relevant item, without required attachment shall not be considered for evaluation.
5. Ahmedabad Municipal Corporation reserves the right to accept any one or reject all of the offers / tenders without giving any reasons thereof.
6. The details given by the Bidders in the post qualification documents will be evaluated as per qualifying criteria; Ahmedabad Municipal Corporation reserves the right to restrict the list of post-qualified Bidder to any number deemed suitable by it. Ahmedabad Municipal Corporation's decision for post-qualifying the Bidders shall be final and binding to all.
7. All information has to be typed or hand written legibly in English language. All pages of the post-qualification document have to be initialed by the Bidder. All corrections, erasures or overwriting, therein, have to be initialed by Bidder.



SECTION – 4

QUALIFICATION CRITERIA AND EVALUATION PROCEDURE

1. QUALIFICATION CRITERIA AND EVALUATION PROCEDURE

1.1. DETAILED ASSESSMENT

The bids received under these single stage three envelope procedures shall be assessed and evaluated based on the qualification criteria and evaluation procedure prescribed hereunder:

- A. Substantially completed works means those works which are at least 90% completed as on the date of submission (i.e. gross value of work done up to the last date of submission is 90% or more of the original contract price) and continuing satisfactorily. For these, a certificate from the employer shall be submitted along with the application incorporating clearly the name of the work, Contract value, billing amount, date of commencement of works, satisfactory performance of the Bidder and any other relevant information.
- B. The Bidder who is not capable of meeting requirement listed below in **Para 1.2** shall not be qualified for the works. Post qualification of Bidder will be based complying minimum criteria regarding their particular experience, financial position, personnel and equipment capabilities and other relevant information as demonstrated by the Bidder's responses in the forms attached to the Letter of application. The qualifications, capacity and resources of proposed Sub Bidders will not be taken into account in determining the Bidder's compliance with the qualifying criteria. **The Bidder to note specifically that all information given including those in the form of various formats must be supported by certificates from respective authorities (not less than Executive Engineer or equivalent) duly attested.**

Bidder can furnish the details on the separate sheets but the format should not be changed in any case.

- Financial capacity
- Past Experience

1.1.1. Financial Capacity

1.1.1.1. Definitions

- **"Financial Statements"** consist of profit-and-loss statements, balance sheet, and if available, cash flow statements (also called "Sources and Applications of funds" statements).
- **"Annual Turnover"**: Average turnover of last three years will be considered for evaluation. Income from *"contractual receipts"* only will be taken into consideration. The income such as interest income, trading income will not be considered.

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Base year and Escalation Factor

The base year shall be taken as **2025-26**

Following enhancement factors will be used for the cost of works executed and the financial figures to bring to a common base for the value of works completed in India.

Financial Year

Base year of inviting tender (2025-2026)	Last date of submission	Multiplying Factor	Actual
2025-2026	zero year	1.00	
2024-2025	One year	1.10	
2023-2024	Two year	1.21	
2022-2023	Three year	1.33	
2021-2022	Four year	1.46	
2020-2021	Five year	1.61	
2019-2020	Six Year	1.77	
2018-2019	Seven year	1.95	

Applicant will indicate actual figures of costs and amounts in the schedule without accounting for the above mentioned factors.

1.1.1.2. Documentation to be used and referred

All Bidders have to submit **audited annual reports/financial reports** of last three years. (If Audited Annual Report is not available, **Un-audited Annual Reports** shall be accepted subject to duly authentication **of Company Secretary** of the Annual Reports). Firms that do not publish financial statements, such as partnerships, submit **pecially prepared statements**. A qualified external auditor should **certify such statements**. Annual reports shall include the auditor's certification.

OR

C.A. Certificate**1.2 Experience**

Factors used in evaluating experience of the bidder in the last three years ending March-2025 are as follows:

Qualifying Criteria

A Average Annual financial turnover during the last 3 years ending 31st March of the previous financial year, should be at least 30% of the estimated costs amount put to tender

B Experience of having successfully completed and substantial completed similar works during last 10 years from last day of previous month from date of tender invited of the following:



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- One similar completed works, each of amounts not less than 50% of the amount put to tender
- OR**
- Two separate similar completed works, each of amounts not less than 30% of the amount put to tender
- OR**
- Three similar completed works, each of amounts not less than 20% of the amount put to tender
- C** Bidders/Companies having registration of “AA” Class issued by AMC or any Central/ State Government or Equivalent Authority.
- D** Bidders/Companies having solvency certificate of National / Schedule Bank amounting to 20% of amount put to tender. The Bank solvency shall not be older than one year period from the date of bidding.

Similar completed works means work related to Construction of Municipal Solid Waste/Hazardous Solid Waste Secured Landfills/Mass Earthwork like Construction of Canals and/or Earthen Bunds including Major Lining Works which include lining of any surface using GCL/CCL/HDPE with Geotextile/Geonet etc. including Construction and Operation of associated Leachate treatment Plant.

ii. For updating completion cost of the work to the current financial year, Procedure narrated in 2(a) ii shall mutatis mutandis apply.

(E) Bid Capacity

The bidder must have Available Bid Capacity (ABC) more than the amount put to tender. Calculated on the Basis of **$ABC = 2 * A * N - B$** .

Where

A = Maximum value of updated total amount of executed in any one year during the last three years (updated to 2025-2026 level) taking into account the works completed as well as works in progress.

N = Number of years prescribed for completion of the works for which bids are invited (Take N value as 22 months)

B = The amount of the existing commitments and on-going works to be discharged during time interval of 'N' years from the bid due date.

Existing commitments shall include all such works for which letters of acceptance of the tenders have been received by bidder till the date on which bidder has submitted his bid for the proposed work.

▪ **1.3 Special Notes**

(A) Disqualification

Even though the Bidders meet the above criteria, they are subject to be disqualified if Bidder or any of its constituent partners have:



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- Made misleading or false representation in the forms, statements, and attachments submitted; or
- Been debarred by Central govt. organization / State govt. organization /AMC.
In case of a proprietary firm, partnership firm the following are the disqualification in case of failure to disclose information by partners or the proprietor:
 - (i) If, any of the partners or the proprietor is debarred by Central govt. organization/ State govt. organization /AMC or any other Agency of Government of India or any of the State Governments.
 - (ii) If, any of the partners or the proprietor has a criminal history or has been convicted by any court of law for any of the offenses under any Indian laws.
 - (iii) If, any criminal proceeding is pending in any court of law in India against any of the partners or a proprietor and if any such proceeding culminates into conviction in last seven years.

Note:

- 1. The experience as sub contractor shall not be considered.**
- 2. Joint Venture shall not be considered.**

**Additional City Engineer, SWM Department
Ahmedabad Municipal Corporation**

Signature and Stamp of the Bidder



SECTION - 5

GENERAL RULES AND DIRECTIONS FOR THE GUIDANCE OF BIDDERS

1. All work proposed to be executed under this contract shall be notified in a form of invitation to tender Posted on a board hung up in the AHMEDABAD MUNICIPAL CORPORATION Office as well as on the website of AMC www.amc.nprocure.com/www.tender.nprocure.com signed by the Additional City Engineer, SWM Department, AMC or any other Officer authorized by the MUNICIPAL COMMISSIONER.

This form will state the work to be carried out, as well as the date for submitting and opening of the tender, earnest money to be deposited with the tender, and the amount of security deposit to be deposited by the successful bidder and the percentage, if any to be deducted from bills. Copies of the specifications, designs, drawings and estimated rates, schedule rates and any other documents required in connection with the work which will be signed by the Additional City Engineer, SWM Department, AMC, for the purpose of identification shall also be opened for inspection by Bidders at the Office of the Additional City Engineer, SWM Department, AMC during office hours.

2. In the event of the tender being submitted by a firm, it must be signed by each partner thereof, and in the event of the absence of any partner, it shall be signed on his behalf by a person holding a power-of-attorney authorizing him to do so.
3. Receipt for payments made on account of any work when executed by a firm, should also be signed by all the partners, except where the bidders are described in their tender as a firm in which case the receipts shall be signed in the name of the firm by one of the partners, or by some other person having authority to give effectual receipt for the firm.
4. Any person who submits a technical bid of tender shall fill up the usual printed form including the column total according to estimated quantities, stating at what rate he is willing to undertake the work. Tenders that propose any alteration in work specified in the said form of invitation to tender, or in the time allowed for carrying out the work, or which contain any other conditions of any sort, will be liable to rejection. Tenders shall have the name and the number of the works to which they refer written outside the envelope.
5. In the event of a tender being accepted, the bidders shall there upon, for the purpose of identification, sign copies of the specifications and other documents mentioned in Rule 1. In the event of a tender being rejected the deposit will be refundable on application.
6. The AHMEDABAD MUNICIPAL CORPORATION shall have the right of rejecting all or any of the tenders without assigning any reasons thereof.
7. No receipt for any payment alleged to have been made by a Bidder regard to any matter relating to this tender or the contract shall be valid and binding to the AHMEDABAD MUNICIPAL CORPORATION unless it is signed by the Additional City Engineer, SWM Department, AMC.



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8. The memorandum of work to be tendered for and the schedule of materials to be supplied by the AHMEDABAD MUNICIPAL CORPORATION and their rates shall be filled in and completed by the office of the Additional City Engineer, SWM Department, AMC before the tender form issued. If a form issued to an intending bidder has not been so filled in and completed, he shall request the said office to have this done before he completes and delivers his tender.
9. All work shall be measured net by standard measure and according to the rules and custom of the AHMEDABAD MUNICIPAL CORPORATION without reference to any local custom.
10. Under no circumstances shall any Bidder be entitled to claim enhanced rates for any items in this Contract.
11. Every Bidder shall, if so desired by the Additional City Engineer, SWM Department, AMC, produce along with his tender a banker's certificate of his financial stability. If he fails to produce such a certificate his tender will not be considered.
12. All corrections and additions or pasted slips should be initialed.
13. The measurements of work will be taken according to the usual method in use in the office and no proposals to adopt alternative methods will be accepted.
14. In case of any discrepancy in rates mentioned in the tender documents due to typographical error or other, the rates mentioned for the same in SCHEDULE OF RATES shall be final and binding.
15. The Additional City Engineer, SWM Department, AMC's decision as to what is the "usual method in use in the office will be final".

Signature and Stamp of the Bidder

**Additional City Engineer, SWM
Department, AMC**



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SECTION - 6

TENDER FOR WORKS

I/We hereby tender for the execution for the **AHMEDABAD MUNICIPAL CORPORATION**(herein before and herein after referred to as "**AMC**") of the work specified in the memorandum within the time specified in such memorandum at the tendered rates specified in schedule B (memorandum showing items of work to be carried out) and in accordance in all respects with the specification, designs, drawings, and instructions in writing referred to in Rule 1 hereof and in clause 13 of the annexed conditions of contract and agree that when materials for the work are provided by AHMEDABAD MUNICIPAL CORPORATION such materials and the rates to be paid for them shall be as provided in schedule A hereto.

Should this tender be accepted I/We hereby agree to abide by and fulfill all the terms and provisions of the conditions of contract annexed hereto so far as applicable, and in default thereof to forfeit and pay to AHMEDABAD MUNICIPAL CORPORATION in office the sums of money mentioned in the said conditions.

Receipt No. _____ dated _____ from AHMEDABAD MUNICIPAL CORPORATION in respect of the sum of Rs. _____ (Rupees _____ only) / A crossed order cheque of Rs. _____ (Rupees _____ only) No. _____ dated _____ on the _____ in favor of the MUNICIPAL COMMISSIONER, AHMEDABAD MUNICIPAL CORPORATION is herewith forwarded representing the earnest money the full value of which is to be absolutely forfeited to AHMEDABAD MUNICIPAL CORPORATION should I/We not deposit the full amount of security deposit specified in the Memorandum, in accordance with Clause 1 of the said conditions.

Bidder:

Address:

Dated the _____ day of _____ 2026

(Witness)

(Address)

(Occupation)

The above tender is hereby accepted by me on behalf of the **AHMEDABAD MUNICIPAL CORPORATION**

**Additional City Engineer, SWM Department,
AHMEDABAD MUNICIPAL CORPORATION**

Dated _____ day of _____ 2026



SECTION – 7

SURETY

This bond is made this _____ day of the month of _____ 2026(Two Thousand Twenty Six) between Shri _____ (hereinafter called the surety) of the first part and the Additional City Engineer, SWM Department, AMC on behalf of the AHMEDABAD MUNICIPAL CORPORATION of the second part.

Whereas the Bidder/Bidders Shri/Ms. _____ of _____ has/have entered into a contract with the AHMEDABAD MUNICIPAL CORPORATION for the works detailed below:-

Name of the work	Tender Amount Rs.	Add. CE, SWM Department, AMC Work Order No. & date Sanctioning Contract
Construction of Phase 2 Of Secured Landfill Site- Civil and Liner Works		

And Whereas one of the conditions of the contract being that the Bidder/ bidders shall give surety/sureties to the AHMEDABAD MUNICIPAL CORPORATION for the due fulfillment of the contract to the full value of the total expenditure of the work.

Now This Bond Witnesses and it is hereby agreed and declared as follows:-

1. I/We Surety/Sureties hereby bind myself/ ourselves responsible for the due fulfillment of the contract in all its respects by the Bidder/Bidders and I/We do hereby agree and undertake to indemnity and keep harmless.

The AHMEDABAD MUNICIPAL CORPORATION jointly as well as severally if the Bidder / Bidders fail / fails to carry out the whole or any part of the contract work as per the conditions and specifications of the work and as agreed to between the parties to the contract to the extent of full value of the total expenditure to be incurred in that behalf by the AHMEDABAD MUNICIPAL CORPORATION provided always that the expression "the Surety/Sureties" hereinbefore used shall include the heirs, executors, assigns or administrators of each and every person in this context.



VOLUME - 1

TECHNICAL BID DOCUMENT

AHMEDABAD MUNICIPAL CORPORATION (AMC), SWM DEPARTMENT

CONSTRUCTION OF SECURED LANDFILL PHASE 2 AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD FOR DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTE

In Witness Whereof the said surety/sureties and the Additional City Engineer, SWM Department, AMCon behalf of the AHMEDABAD MUNICIPAL CORPORATION have hereinto set their respective hands this _____ day the month of _____ of the year 2026.

Surety

Signed in the presence

1. _____

2. _____

**Additional City Engineer, SWM Department,
AHMEDABAD MUNICIPAL CORPORATION**

Sealed with the common seal of the
AHMEDABAD MUNICIPAL CORPORATION in the presence of

1. _____

2. _____

**VOLUME - 1****TECHNICAL BID DOCUMENT****AHMEDABAD MUNICIPAL CORPORATION (AMC), SWM DEPARTMENT****CONSTRUCTION OF SECURED LANDFILL PHASE 2 AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD FOR DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTE****SECTION –8****MEMORANDUM**

No.	ITEM DESCRIPTION	VALUES/REMARKS
1	General Description of Work	Construction Of Secured Landfill Phase 2 Of Ahmedabad Municipal Corporation At Survey No. 337/P, At ShahwadiEkatra, Gyaspur, Ahmedabad, Taluka& District – Ahmedabad, Gujarat, India.
2	Estimated Cost	Rs. 66,96,58,612.52
3	Earnest Money Deposit	Rs. 66,96,590.00
4	(A) Security Deposit	Total 5% of tender amount
	Demand Draft/Pay Order/Banker's Cheque/ Bank Guarantee of any Nationalized Bank or Scheduled Bank at the time of allotting work	
	(B) Percentage to be deducted (1) From Running Account bills	2.0% percent of work done
	(C) Mobilization Advance	No Mobilization Advance shall be issued by the corporation
5	Time allowed for the Completion of work from date fixed in written Order to commence	18 months (Excluding Monsoon, i.e. 16 th June to 15 th October).
6	Compensation for delay in execution of work	0.20 percent of remaining work amount of the tendered cost of the whole work per day, Limited to maximum 10% of the remaining work amount.
7	The progress of the work should confirm to the following schedule: 1) 10% of the work to be done in	25% of the time
	2) 40% of the work to be done in	50% of the time
	3) 70% of the work to be done in	75% of the time
	4) 100% of the work to be done in	100% of the time
8	Defect Liability Period	5 years (After total completion of whole work and issue of Work Completion Certificate)
9	Water Charges	Bidder shall have to make his own arrangement of water supply. If Bidder wishes, and if AMC agrees upon, to have water from AMC, he shall have to inform AMC in written within 30 days from starting state of work. Charges towards the same shall be as per decided by AMC

Signature and Stamp of the Bidder**Additional City Engineer, SWM Department, AMC**



SECTION – 9

SPECIAL CONDITIONS OF CONTRACT

The person/persons whose tender may be accepted [here- in after called the Bidder, which expression shall unless excluded by or repugnant to the context include his heirs, executors, administrators and assignees] shall [within 10 days of the receipt by him of the notification of the acceptance of his tender] deposit with Additional City Engineer, SWM Department, AMC cash or Government securities endorsed to the Additional City Engineer, SWM Department, AMC sum sufficient which will make up the full security deposit specified in the tender.

If the amount of the security deposit to be paid in lump sum within the period specified above is not paid the tender contract already accepted shall be considered as cancelled. The security deposit lodged by Bidder shall be refunded after the expiry of the Defects Liability period as shown in the attached Memorandum after deducting dues, if any, which become liable to be recovered from the Bidder under the terms and conditions of this Agreement.

The successful tender shall have to pay as initial security deposit of 5.0% of the tendered amount. It shall be in the form of Demand Draft/Pay Order/Banker's Cheque/Bank Guarantee/Fixed deposit issued in favor of "AHMEDABAD MUNICIPAL CORPORATION" by nationalized bank/Scheduled Bank located at Ahmedabad only.

The initial security deposit at 3.0% submitted will be refunded after payment of final bill and remaining 2.0% of security deposit deducted after the expiry of defect liability period and after rectifying the defects found, if any, within defect liability period as intimated by AMC.

AMC will not pay any amount as a mobilization advance to the bidder.

If the security deposit is not paid within 15 days from the letter of intent then penalty at the rate of per day as per rules of the amount of security deposit will be charged.



SECTION – 10

DESCRIPTION AND SCOPE OF THE PROJECT

CONSTRUCTION OF SECURED LANDFILL PHASE 2 OF AHMEDABAD MUNICIPAL CORPORATION AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD, TALUKA & DISTRICT – AHMEDABAD, GUJARAT, INDIA

Scope of Work

The scope of work is to construct Phase 2 of Secured Land Fill Site as per Solid Waste Management Rules 2026 criteria.

A) Scope of Construction of Secured Landfill Phase:

Scope of Construction of the Secured Engineered solid waste Landfill site includes Mass Excavation, grading, dressing, leveling, refilling, Construction of earthen bund on the top at the EGL in specified slope and height, making impervious liner system on bottom - comprising of providing and laying 900 mm thk. Compacted Clayey Soil, followed by GeoSynthetic Clay Liner, 1.5 mm thk. HDPE geomembrane liner, Non woven Geotextile Liner, Drainage Layer, Leachate Collection System and Leachate Collection Tanks at the bottom of the phase and also providing liner system on Side Slopes, horizontal berm and earthen bund which comprises of providing and laying of 900 mm thk. Compacted Clay Liner or Amended Clay Liner, followed by Geo Synthetic Clay Liner, 1.5 mm thk. HDPE liner, followed by Non woven Geotextile Liner followed by providing and laying of Geonet on geotextile liner and finally covering geonet with 150 mm thk. RCC layer on the excavated inner side slopes, horizontal berm as well as earthen bund, making of leachate tanks, curb walls on the top of the Phase, Peripheral service road, Storm water drains, Approach ramp into the Phase and leachate collection systems etc., as specified in the drawings and schedule of rates. It also include Construction and Operation of Associated Leachate treatment Plant including Primary, Secondary and Tertiary treatment of Leachate so as to render the use of treated leachate either onsite or to make it safe for its further disposal into near by STP.



SECTION - 11

GENERAL INFORMATION TO BIDDERS

- 1) Several documents forming the contract are the essential parts of the contract and requirement occurring in all, they are intended to be mutually explanatory and complementary and to describe and provide for a complete work.
- 2) The tender for, the work shall remain open for a period of 180 days (One Hundred Eighty days) from the date of opening of tenders for the work. The offer having validity less than 180 days will be rejected outright. The bidders will not be allowed to withdraw or modify the offer of his/their own during the course of finalization of tender.
- 3) The bidder shall provide drinking water facilities to the workers /laborers employed by him. However, water and power facilities shall be provided by AMC at one point on the site. Further as per requirement the bidder shall extend it on his own at other points in the site.
- 4) Time of completion of the project is 18 (Eighteen) months excluding the monsoon period and is to be strictly followed otherwise it shall attract penalty as discussed in the tender. However, the time limit for Construction work shall start after getting EC from Govt. Authority.
- 5) The bidder shall provide the amenity of shade and shelter to the workers, laborers and their children on work as soon as the work starts.
- 6) Incomplete tender that does not fulfill any of the above conditions will be liable to be rejected. Tender will also be liable to be rejected if:
 - i) The bidder proposes any alteration in the work specified or in time allowed in carrying out the works or make corrections in Schedule of quantities and Rates.
 - ii) Any of the page or pages in the tender is/are removed or replaced.
 - iii) The rate is not entered in ink, in figures and words in Schedule of quantities and rates as also amount in figures is not written and signed.
 - iv) The bidder does not initial all corrections, additions or pasted slips.
 - v) Any erasure is made in the tender and is not authenticated by full signature.
 - vi) The bidder or in the case of a firm, each partner or the person holding the power of attorney thereof does not sign or the signature(s) is (are) not attested by the witness wherever it is required.



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- vii) Earnest money for full amount and in required form is not paid with the tender.
- viii) The bidder returns the tender documents without signing relevant pages of the bid.
- 7) Late tenders (i.e. tender received after the specified time of opening), delayed tenders (i.e. tenders received before the time of opening but after the due date and time of receipt of tenders) and post tender offers shall neither be opened nor be considered at all.
- 8) The tenders received after the time of date specified in the tender notice shall not be received by the concerned office from the post man for which date and time may be recorded on the cover of the tender as to when tender was refused by the officer.
- 9) The rate quoted by the bidder shall be inclusive of all taxes, duties, charges etc. but without GST and as per government rules GST shall be paid extra to the bidder.
- 10) This work is inclusive of correspondence work to the client and Government Departments etc. All this work should be done as per standard practices and by following labour, factory, electrical, GPCB, Environment Clearance and all other old and new law and order, Indian standards etc. as applied of Local, State and Central Govt. of India.
- 11) Monitoring shall be done as per guidelines given by Ahmedabad Municipal Corporation. Contractor has to maintain all the parameters within the stipulated limits or he will be penalized for not maintaining the parameters given by GPCB and client. All expenditure incurred for the same like, suit fee, court fee, case fee, or the penalty charged by GPCB shall be deducted from his pending bills or Security Deposit.



SECTION – 12

GENERAL TERMS AND CONDITIONS OF THE CONTRACT

Instructions to Bidders

Intent and Purpose: It is the intent and purpose of this contract on which bids are sought to assure the smooth and timely construction of a Municipal Solid Waste disposal Secured Engineered Landfill Phase 2, at one site at Survey No. 337/P, At Shahwadi Ekatra, Gyaspur, Ahmedabad, Taluka & District – Ahmedabad, Gujarat, India where solid wastes originating within the AHMEDABAD MUNICIPAL CORPORATION limits, or for which the AHMEDABAD MUNICIPAL CORPORATION has accepted responsibility, will be disposed of.

A.1 Financial Position

A.1.1 The audited balance sheets for the last three years should be submitted and must demonstrate the soundness of the bidders financial position, showing long-term profitability. Where necessary, the Employer will make enquiries with the bidder's bankers.

A.2 Litigation History

A.2.1. The bidders should provide accurate information on any litigation history or arbitration resulting from contracts completed or under execution by him over the last three years. This should also include such cases, which are in process/progress. A consistent history of awards against the bidder or any partner of a joint venture may result in failure of the bid. In case the bidder has not provided such information and has come to the notice of the Authority, the tender will be rejected at whatsoever stage and in such case all the losses that will arise out of this issue will be recovered from the bidder/bidder and he will not have any defense for the same.

A.3. All bidders shall furnish as an attachment to the bid document a list of Professional and Technical Personnel with their qualifications and experience, who are to be deployed in the construction of Secured Engineered Landfill facility together with their deployment schedule on landfill site, which should include at least one engineer with specialization in Geotechnical / Soil mechanics and at least one Civil Engineer who have experience of the construction of a Secured Engineered Landfill Site.

A.4. All bidders shall supply detailed inventories of their equipment and all accessories for each piece so listed. All leased equipment shall be separately listed and show the time remaining on each leased machine and any options of renewal. All new equipment to be acquired in fulfillment of this contract must be available on the effective date when construction start.

A.5 All bidders shall be required to demonstrate to the satisfaction of the AHMEDABAD MUNICIPAL CORPORATION that they have adequate financial resources, experienced personnel, and expertise to perform the services required by the specifications.



A.6. Inspection of Site: All bidders shall visit the site of the proposed Secured Engineered Landfill and familiarize themselves with the project, including all requirements of the plan. Submission of a bid shall be deemed conclusive by the AHMEDABAD MUNICIPAL CORPORATION that a site visit has been made, and it shall constitute a waiver of all claims of error in bid, withdrawal of bid, or payment of extras, or any combination thereof under the executed contract or any revision thereof..

B. INSTRUCTIONS TO BIDDERS

1. Conditional tender will not be accepted.
2. The Bidder shall strictly observe all the requirements laid down in the contract Labour (Regulation and Abolition) Act, 1970 and the contract Labour (Regulation and Abolition) Gujarat Rules, 1972 and other Acts as amended from time to time so far as applicable.
3. Bidder shall have to execute items included in price bid. Quantities of any items as per the site requirement may vary in any proportion for which the bidder shall be allowed to carry on his work, however he shall have to work without claiming any extra rate.
4. The Bidder shall be responsible for any damage occurring to the AMC's property, general public or property of public or underground cables or overhead electrical lines laid by any agencies or incase the cause is attributed to the staff of the agency. The bidder shall have to get the same rectified at his own cost and risk, or otherwise, the same shall be attended to, by the AMC at the risk and cost of the bidder.
5. Price Escalation or price variation shall be given as per tender conditions.
6. The Bidder shall have to attach the following documents with the tender without which tender will be liable to be rejected
 - a. A true copy of registration as an approved bidder of state govt./municipal corporation etc.
 - b. List of works already completed in the prescribed proforma specially listing the details of the construction of landfill works.
 - c. List of plants and machinery in good working order available with the Bidder for the proposed work, in prescribed Performa.
 - d. Declaration regarding works in hand with the Bidder in prescribed Performa.
 - e. An overall schedule of the "Work Plan" of the project based on 'Network Technique Method', PERT / CPM for appreciating his method of planning, scheduling and control of project execution.



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7. Tender will also be liable to be rejected if:

- a. Any of the page or pages in the tender is/are replaced.
- b. The item rate's not entered in ink, in figures & words in schedule of Quantities and rates and also amount in figures is not written and signed.
- c. All corrections, additions, or pasted slips are not initialed by the bidder.
- d. Any erasure is made in the tender.
- e. The bidder or in the case of a firm, each partner or the person holding the power of attorney thereof does not sign or the signature(s) is are not attested by the witness it is required.
- f. Tender fee and Earnest money for amount indicated is not paid with the tender.
- g. The bidder returns the tender document without signing all the pages of the bid.

C. LIQUIDATED DAMAGES

- 1 If the bidder fails to complete work or a designated part thereof by stipulated completion date for the work unless extended by the Additional City Engineer, SWM Department, AMC. The amount of liquidated damages shall, be maximum limit of 10% of the remaining work amount.
2. Delay in excess of one hundred days beyond the extended period if granted will be a cause for termination of the contract and forfeiture of all security for performance.

Bidder's Sign & Stamp/Address

**Additional City Engineer, SWM Department,
AHMEDABAD MUNICIPAL CORPORATION**



SECTION - 13

IMPORTANT CONDITIONS OF CONTRACT

- 1) The tender document shall be submitted in One separate sealed cover of the Technical bid. The bidder shall clearly state in the forwarding letter (in duplicate) to be enclosed with the tender document, the deviation from General Terms and Conditions, if any, with cross references. If no such letter is received, it will be presumed that the bidder agrees entirely with the General and Technical Terms and Conditions. Tender Fee, EMD in the prescribed form as well as all other documents should be sealed in the separate envelope and packed in envelope marked "Technical Bid Document". This envelope should be enclosed in a main envelope duly sealed and signed and stamped by the bidder on the opening area of the main envelope. Technical Bid document received without Tender Fee and EMD shall be rejected outright. Financial Bid Document shall have to be submitted Online only and not in hard copy which shall be opened only of the qualified bidders.
- 2) All pages of the tender document should be signed by the bidder.
- 3) The work shall be earned out strictly as per drawings and details and instructions of the AMC&/or its authorized persons including Engineer - in - charge/authorized representative of the consultant.
- 4) Cement used in all RCC, masonry, plaster or in any civil work should be of 53 grade ISI make as approved by the AMC.
- 5) The bidder cannot sublet any part of work to any sub bidder.
- 6) The bidder has to make his own arrangements for the storage of materials and he will be solely responsible for its safety and damage.
- 7) It shall be the sole responsibility of the bidder to meet with any statutory or any other liability arising out of any accident or casualties that may occur during the course of the execution of the project.
- 8) Bidder has to furnish his full postal address, phone numbers etc.
- 9) If any extra item arises during the progress of work, the rate of the same shall be priory finalized in consultation with the AMC /consultant and only after the finalization of the same the item may be executed.
- 10) The AMC has the right to reject any of the bids out rightly without assigning any reason.



- 11) The bidder has to hand over the clean and clear possession of the site on completion of the work or in the event of rescindation of the work by the AMC irrespective of the fact that settlement of the bill is pending.
- 12) In case of dispute or differences arising relating to interpretation, construction of any clause relating to this tender document, same shall be referred to the arbitrator to be appointed by the AMC and whose decision shall remain final and conclusive for both the parties.
- 13) The bidder has to arrange for dewatering and cleaning of the site during the execution of project work at his cost.
- 14) The clause relating to the security deposit/earnest money/performance bond including its forfeiture shall be governed as mentioned in the tender document.
- 15) LAND FOR RESIDENTIAL ACCOMODATION: Contractor shall arrange Land for residential accommodation for staff and labor will be made by own cost.
- 16) STORES TO BE SUPPLIED BY AMC: No materials shall be supplied as such by the AMC.
- 17) TESTING OF DIFFERENT MATERIALS: The bidder shall bear all the charges which may occur due to testing of the different materials used in the project. The details are given in the table showing frequency of tests to be performed in the Quality Assurance Plan as given in the tender.

21) Definition of terms

In the contract documents as herein defined where the context so admit, the following words, and expressions will have the following meanings:

- a) The "AMC" means AHMEDABAD MUNICIPAL CORPORATION (AMC) in India having its Central office at: Additional City Engineer Office, Solid Waste Management, Ahmedabad Municipal Corporation, 2nd floor, Sardar Patel Bhavan, Danapith, Ahmedabad – 380 001.
- b) The "bidder" means the person or the persons, firm or Corporation whose tender has been accepted by the AMC and includes the bidder's legal representative, his successor and permitted assignees.
- c) The "Engineer - in - charge" means the person designated as such by the AMC and shall include those who are expressly authorized by him to act for and on his behalf for operation of this contract.
- d) The "consultant" shall mean technical consultant for the project, or the representative/successors/assignee as designated by the office.
- e) The "Work" shall mean the works to be executed in accordance with the contract or part thereof the case may be and shall include all extra, additional, altered or substituted works as required for the purpose of the contract.



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- f) The "Permanent Work" means and includes works which will be incorporated in and form a part of the work to be handed over to the AMC by the bidder on completion of the contract.
- h) "Construction Equipment" means all the appliances and equipment of whatsoever nature for the use in or for the execution, completion, operation or maintenance of the work unless intended to form part of the Permanent Work.
- i) "Site" means the areas on which the permanent works are to be executed or carried out and any other places provided by the AMC for purpose of the contract.
- j) "Contract documents" means collectively the Tender documents, designs, drawings, specifications, and agreed variations, if any. Contract and such other documents constituting the tender and acceptance thereof.
- k) "Contract" shall mean the agreement between the AMC and the bidder for the execution of the works including there in all contract documents.
- l) "Specifications" shall mean the various technical specifications attached and referred to the tender documents. It shall also include the latest edition of relevant Indian standard specifications published before entering in to contract.
- m) "Drawings" shall include maps, plans and tracings or prints thereof with any modifications approved in writing by the AMC&/or its authorized persons including Engineer - in - charge and such other drawings as may from time to time be furnished or approved in writing by the AMC&/or its authorized persons including Engineer - in - charge.
- n) "Tender" means the tender submitted by the bidder for acceptance by the AMC.
- o) "Alteration Order" means an order given in writing by the AMC&/or its authorized persons including Engineer - in - charge to effect additions to or deletions from and alteration in the works.
- p) "Period of liability" in relation to a work means the specified period from the date of completion certificate up to the date of issue of final certificate during which the bidder stands responsible for rectifying all defects that may appear in the works.
- q) "Appointing authority" for the purpose of arbitration shall be the Additional City Engineer Office, Solid Waste Management, Ahmedabad Municipal Corporation, 2nd floor, Sardar Patel Bhavan, Danapith, Ahmedabad – 380 001 or any other person so designated by the AMC.

(SIGNATURE OF THE BIDDER ALONG
WITH THE STAMP AND DATE)



SECTION – 14

GENERAL INSTRUCTION TO BIDDERS

1) Document:

a) Tenders as submitted shall consist of the following:

TECHNICAL BID: VOLUME – 1

FINANCIAL BID: VOLUME –2

- i) Complete set of tender documents as supplied, duly filled in and signed by the bidder and submitted in separate cover for “Technical Bid” Only and “Financial Bid” shall be submitted online only.
- ii) Earnest money in the manner specified in the clause thereof.
- iii) Information regarding the bidders in the Performa enclosed.
- iv) Detail of work of similar type and magnitude carried out by the bidder in the Performa given in the document.
- v) Details of construction plant and equipment available with the bidder for using in this work in the Performa under the head “Information regarding Equipment” which the bidder propose to use for this work.

2) All pages are to be initialed:

All signatures in tender documents shall be dated as well as all the pages of all sections of tender documents shall be initialed at the lower right hand corner and signed whenever required in the tender papers by the bidder or by a person holding power of attorney authorizing him to sign on behalf of the bidder before submission of tender.

3) Signature of bidder:

- i) The tender shall contain the name, address of residence with contact numbers and place of business with complete address and contact numbers of the person or persons making the tender and shall be signed by the bidder with his usual signature. Partnership firms shall furnish the full names of all partners and their addresses and contact numbers in the tender. It should be signed in the partner's name by all the partners or duly authorized representative followed by the name and designation of the person signing. Tender by a corporation shall be signed by an authorized representative and a power of Attorney on that behalf shall accompany the tender. A copy of the constitution of the firm with name of all partners shall be furnished.
- ii) When a bidder signs a tender in a language other than English, the total amount tendered should in addition, be written in the same language. The signature should be attested by at least one witness.



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4) Witness:

Witness and sureties shall be persons or status and property and their names, occupation and address shall be stated below their signatures.

5) Right of the AMC to Accept or Reject Tender:

The right of accepting of the tender will reset with the AMC. The AMC however, does not always accept the lowest tender and reserves to itself the authority to reject any or all the tenders received without assigning any reason whatsoever. The whole work may be split in between two or more bidders or accepted in part and not entirely if considered expedient. Tenders in which any of the particulars and prescribed information are missing or are incomplete in any respect and/or the prescribed conditions are not fulfilled are liable to be rejected.

6) Signing of the Contract:

The successful bidder shall be requested to execute an agreement in the Performa attached with the tender document within 10 days of the receipt as a token of acceptance of the tender. In the event of failure on the part of the successful bidder to sign the agreement within the above stipulated period, the earnest money or his initial deposit will be forfeited and the acceptance of the tender shall be considered as cancelled.

7) Field Management:

The field management will be the responsibility of the AMC&/or its authorized persons including Engineer - in - charge who will be nominated by the AMC. The AMC&/or its authorized persons including Engineer - in - charge may also authorize his representatives to perform his duties and functions.

8) Co-ordination of Work:

The AMC&/or its authorized persons including Engineer - in - charge shall co-ordinate the works of various agencies engaged at site to ensure minimum disruption of work carried out by different agencies. It shall be the responsibility of the bidder to plan and execute the work strictly in accordance with site instructions to avoid hindrance to the work being executed by other agencies.



SECTION - 15

GENERAL OBLIGATIONS

CLAUSE 1: Interpretation of Contract Documents:

Except if and to the extent otherwise provided by the contract, the provisions of the General Conditions of contract and Important conditions shall prevail over those of any other documents forming part of the contract. Several documents forming the contract are to be taken as mutually explanatory. Should there be any discrepancy inconsistency, error or omission in the contracts or any of them the matter may be referred to the AMC&/or its authorized persons including Engineer - in - charge who shall issue to the bidder instructions directing in what manner the work is to be carried out. The decision of the AMC&/or its authorized persons including Engineer - in - charge shall be final and conclusive and the bidder shall carry out work in accordance with this decision.

Works shown upon the drawing but not mentioned in the specifications or described in the specifications without being shown on the drawings shall nevertheless be held to be included in the same manner as if they had been specifically shown upon the drawings and described in the specifications.

CLAUSE – 2: Headings and Marginal Notes

All headings and marginal notes to the clauses of these General and Important Conditions of Contract or to the specifications or to any other tendered document are solely for the purpose of giving a concise indication and not a summary of the contents thereof, and they shall never be deemed to be part thereof or be used in the interpretation or construction thereof of the contract.

CLAUSE – 3: Singular and Plural

In these contract documents unless otherwise stated specifically, the singular shall include the plural and vice versa wherever the context so requires. Words importing persons shall include relevant corporate companies/registered associations/body of individuals/firm of partnership.

CLAUSE – 4: Important Conditions of Contract:

Important Conditions of Contract Shall be read in conjunction with the General Conditions of Contracts specifications of work, drawings and any other documents forming part of this contract wherever the context so requires. Notwithstanding the subdivision of the documents into these separate sections and volumes every part of each shall be deemed to be supplementary to and complementary of every other part and shall be read with and into the contract so far as it may be practicable to do so.



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Where any portion of the General Conditions of Contract is repugnant to or at variance with any provisions of the Important Conditions of Contract then, unless a different intention appears the provisions of the important Conditions of Contract shall be deemed to over-ride the provisions of the General Conditions of Contract and shall to the extent of such repugnancy, or variations, prevail.

Where it is mentioned in the specifications that the Bidder shall perform certain work or provide certain facilities, it is understood that the bidder shall do so at his cost.

The materials, design and workmanship shall satisfy the relevant Indian Standard, the job specifications contained herein and codes referred to. Where the job specification stipulate requirements in addition to those contained in the standard codes and specifications, these additional requirements shall also be satisfied.

CLAUSE – 5: Bidder to Obtain his Own Information

The bidder in fixing his rate shall for all purposes whatsoever is deemed to have himself independently obtained, all necessary information for the purpose of preparing his tender. The correctness of the details, given in the tender Document to AMC the Bidder to make up the tender is not guarantee.

The bidder shall be deemed to have examined the Contract Documents, to have generally obtained his own information in all matters whatsoever, that might affect the carrying out the works at the scheduled rates and to have satisfied himself to the sufficiency of his tender. Any error in description of quantity or omission there from shall not vitiate the contract or release the Bidder from executing the work comprised in the contract according to drawings and specifications at the scheduled rates. He is deemed to have known the scope, nature and magnitude of the works and the requirements of materials and labor involved etc., and as to what all works he has to complete in accordance with the contract documents whatever be the defects,-omissions or errors that may be found in the Contract documents. The bidder shall be deemed to have visited surroundings to have satisfied himself to the nature of all existing structures, if any and also as to the nature and the conditions of the Railways, roads, bridges and culverts, means of transport and communications, whether by land, water or air, and as to possible interruptions thereto and the access and excess from the site, to have made inquiries, examined and satisfied himself as to the sites for obtaining sand; stones, brick and other materials, the sites for disposal of surplus materials, the available accommodation as to whatever required depots and such other buildings as may be necessary for executing and completing the works, to have made local independent inquiries as to the sub-soil, subsoil water and variations thereof, storms, prevailing winds climatic conditions and all other similar



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matters effecting these works. He is deemed to have acquainted himself as to his liability for payment of Government taxes, customs duly and other charges.

Any neglect or failure on the part of the Bidder in obtaining necessary and reliable information upon the foregoing or any other matters affecting the contract shall not relieve him from any risks or liabilities or the entire responsibility from completion of the works at the scheduled rates and time in strict accordance with the contract documents,

No verbal agreement or inference from conversation with any officer or employee of the AMC either before or after the execution of the contract agreement shall in any way affect or modify any of the terms or obligations herein contained.

CLAUSE – 6: Time of performance

The work covered by this contract shall be commenced within 15 days after the receipt of the letter of the acceptance of tender or state in work order and may be completed in stages on or before the dates as mentioned in the time schedule of the completion of the work. The bidder should bear in mind that time is the essence of this agreement unless such time be extended pursuant to the provision of the relevant clause. Request for revision of construction time after tenders are opened will not receive consideration.

CLAUSE – 7: Time Schedule of Construction/Jobentrusted

The general time schedule of construction is given in the tender document. Bidder should prepare a detailed monthly or weekly construction program jointly with the AMC&/or its authorized persons including Engineer - in - charge within ten days of receipt of Letter of Intent or acceptance of tender or issue of work order. The work shall be executed strictly as per the time schedule given in this document. The period of construction given includes the time required for testing, recertification, if any, retesting and completion in all respect.

CLAUSE – 8: Force Majeure

Any delays in or failure of the performance of either party hereto shall not constitute default hereunder or give rise to any claims for damages, if any, to the extent such delays or failure of performance is caused by occurrences such as Acts of God or the public enemy expropriation or confiscation of facilities by Government authorities compliance with any order of any Government authorities, acts of war, rebellion or sabotage or fires, floods, earthquakes, riots or illegal strikes.

**CLAUSE – 9: Extension of time**

If the bidder shall desire an extension of the time for completion of the work on the grounds of his having being unavoidably hindered in its execution or on any other grounds, he shall apply in writing to the AMC&/or its authorized persons including Engineer - in - charge within ten days of the date of the hindrance on account of which he desire such extension as aforesaid and the AMC&/or its authorized persons including Engineer - in - charge shall if in his opinion (which shall be final) reasonable grounds have been shown therefore authorize such extension of time as may in his opinion be necessary or proper.

CLAUSE – 10: Damages for Delay

The time allowed for carrying out the work as entered in the tender shall be strictly observed by the Bidder. The work shall throughout the stipulated period of the contract be proceeded with all the diligence (time being deemed to be the essence of the contract) and the bidder shall pay to the AMC as damages, penalty is subject to maximum of 10% of the remaining work amount or actual damage/loss whichever is higher and necessary action will be taken by the AMC.

CLAUSE – 11: Bidder Remains Liable to Pay Compensation if Action Not Taken

In any case in which any of the powers conferred upon the AMC thereof shall have become exercisable and the same had not been exercised, the non exercisable thereof shall not constitute a waiver of any of the conditions hereof and such powers shall notwithstanding be exercisable in the event of any further case of default by the bidder for which by any cause or causes hereof he is declared liable to pay compensation amounting to the whole of his security deposit and the liability of the bidder for past and further compensation shall remain unaffected. In the event of the AMC putting in force the powers under sub clauses vested in him under preceding clauses he may, if he so desires, take possession of all or any tools, & plants, materials and stores in or upon the works or the site thereof belonging to the bidder or procured by him and intended to be used for the execution of the work or any part thereof carrying or allowing for the same in account at the contract rates-or in case of these not being applicable at current market rates to be certified by the AMC &/or its authorized persons including Engineer-in-Charge whose certificate thereof shall be final, otherwise in AMC&/or its authorized persons including Engineer-in-Charge may give notice in writing to the bidder or his clerk of the works, foreman or other authorized agent, requiring him to remove such tools, plant, materials or stores from the premises (within a time to be specified in such notice), and in the event of the bidder failing to comply with any such requisition, the AMC&/or its authorized persons including Engineer-in-Charge may remove them at the bidder's expense or sell them by auction or private sale on account of the bidder and same shall be at his risk in all respects without any further notice as to the date, time or place of sale



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and the certificate of the AMC&/or its authorized persons including Engineer-in-Charge as to the expense of any such removal and the amount of the proceeds and expense of any such sale shall be final and conclusive against the bidder.

CLAUSE – 12: No Compensation for Alternation in or Restriction of Work

If at any time from the commencement of the work the AMC shall for any reason whatsoever not require the whole or part thereof as specified in the tender to be carried out, the bidder shall follow the instructions given and not execute the work which is not required. The bidder in this case shall have no claim whatsoever on account, of any profit or advantage which he might have derived from the execution of the work in full but which he did not derive in consequence of the full amount of the work not having been carried out; neither shall he have any claim for damages by reason of any alterations having been made in the original specifications, drawings, designs and instructions which shall involve any curtailment of the work as originally contemplated nor for any additional cost incurred by him/it for the execution of the said work.

CLAUSE – 13: Change in Constitution

Where the bidder is a partnership firm the prior approval, in writing, of the AMC shall be obtained before any change is made in the constitution of the firm. Where the bidder is an individual or a Hindu undivided family business concern, such approval as aforesaid shall likewise be obtained before such bidder enters into any agreement with other parties where under, the reconstituted firm would have the right to carry out the work hereby undertaken by the bidder. In either case if prior approval as aforesaid is not obtained, the contract shall be deemed to have been allotted in contravention of condition of the contract hereof and the same action may be taken and the same consequence shall ensue as provided in the said clause.

CLAUSE – 14: If the Bidder dies or becomes insolvent or offer bribe to a public officer or sublet the work without written approval of the AMC:

Without prejudice to any of the rights or remedies under this contract if the bidder dies in case of an individual, the contract shall be terminated and account to be settled within a reasonable period of time and his successor or nominees shall have no right for the remaining work. The contract shall not be assigned or sublet without the written approval of the Engineer – In – Charge. And if the bidder shall assign or sublet his contract or attempt to do so or become insolvent or commence any proceeding to get himself be adjudicated an insolvent or make any compromise with his creditors, or attempt to do so, the Engineer – In – Charge may, by notice in writing rescind the contract. Also, if any bribe, gratuity, gift, loan, perquisite, reward or advantage, pecuniary or otherwise, shall either directly or indirectly be given, promised or offered by the bidder, or any of



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his servants or agents to any public officer or person in the employment of government in any way relating to his office or employment, or if any such officer or person shall become in any way directly or indirectly interested in contract, the Engineer – In – Charge may thereupon by notice in writing rescind the contract. In the event of contract being rescinded, the security deposit of the bidder shall thereupon stand forfeited and be absolutely at the disposal of government and the same consequence shall ensure as if the contract has been rescinded under the clause hereof and in addition the bidder shall not be entitled to recover or be paid for any work thereof actually performed under the contract.

CLAUSE – 15: Officers of the AMC /technical consultant not individually liable

MUNICIPAL COMMISSIONER, AMC or Official or employee of the AMC/technical consultant shall in any way be personally not bound or liable for the acts or obligations of the AMC under contract or answerable for any default or omission in the observance of performance of any of the acts, matters or things which are herein contained.

CLAUSE – 16: AMC not Bound by Personal Representations

The bidder shall not be entitled to any increase on the schedule rates or any other right or claim whatsoever by reason of any representation, explanation or statement or alleged representation, promise or guarantees given or alleged to have been given to him by any person.

CLAUSE – 17: Sub Contract for temporary works etc.

No sub contracting of any of the works shall be allowed by the bidder. All the stipulated works whether temporary or as scheduled shall be executed by the bidder only with the deputed staff of the bidder on site.

CLAUSE – 18: Bidders liability not limited by Sub Bidders

The bidder shall remain solely responsible for the quality and proper and expeditious executions of the works and the performance of all the conditions of the contract in all respects and cannot transfer any errors to any sub bidders.

CLAUSE – 19: No remedy for action taken under this clause

No action taken by the AMC under the clause shall not relieve the bidder of any of his liabilities under the contract or give rise to any right to compensation.

**CLAUSE – 20: Power of Entry**

If the bidder not commence the work in the manner previously described in the contract documents or if he shall at any time in the opinion of the AMC &/or its authorized persons including Engineer - in - charge fail to carry out the works in conformity with the contract documents or fail to carry out the works in accordance with the time schedule or substantially suspended works for a period of 14 days without authority from the AMC&/or its authorized persons including Engineer - in - charge or fail to carry out and execute the works to the satisfaction of the AMC&/or its authorized persons including Engineer - in - charge or fail to supply sufficient or suitable constructional plant, temporary works, labor, materials or things or commit or suffer or permit any other breach of any of the provisions of the contract on his part to be performed or observed or persists in any of the above mentioned breaches of the contract or the fourteen days after notice in writing shall have been given to the bidder by the AMC&/or its authorized persons including Engineer - in - charge requiring such breach to be remedied or if the bidder shall abandon the works or If the bidder during the continuance of the contract shall become bankrupt, make any arrangement or composition with his debtors or permit any execution to be levied or go into liquidation whether compulsory or voluntary etc., then in any such case the AMC shall have the power to enter upon the works and take possession thereof and of the materials, temporary works, constructional plants and stop thereon and to revoke the bidders license to use the same and to complete the works by his agent, other bidders or workmen or to relate the same upon any terms and to such other person, firm or AMC at the AMC in its absolute discretion making proper to employ and for the purpose aforesaid to use or authorize the use of any materials, temporary works, constructional plants and stock as aforesaid and in such case the bidder shall have no right or any type of claim on the AMC . The bidder for the said materials other than such as may be certified in writing by the AMC&/or its authorized persons including Engineer - in - charge to be responsible. Bidder for the use for the temporary period of the said works, constructional plants and stock or being liable for any lose or damage thereto and if the AMC shall by reason of his taking possession of the works or of the works being completed by other bidder the due account being taken of any such extra work or works which may be omitted) then the amount of such excess as certified by the AMC &/or its authorized persons including Engineer - in - charge shall be deducted from any money which may be due for work done by the bidder and in addition thereto the bidder shall indemnify the AMC for the loss actually incurred for the damages caused to the AMC under the contract and not paid for. Any deficiency shall forthwith be made good and paid to the AMC by the bidder and the AMC shall have power to sell in such manner and for



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such price as he may think fit or all any of the constructional plant, materials etc. constructed by the belonging to and to recoup and retain and said deficiency or any part thereof out of the proceed of the sale.

CLAUSE – 21: Other Agencies at Site

The bidder shall have to execute the work in such place and condition where other agencies will also be engaged for other works such as site grading, filling, and leveling, electrical and mechanical engineering works, etc. No claim shall be entertained due to work being executed in the above circumstances.

CLAUSE – 22: Notice

Any notice hereunder may be served on the bidder or his duly authorized representative at the Job site or served by registered mail direct to the address furnished by the bidder. Proof of issue of any such notice shall be conclusive of the bidder having been duly informed of all contents therein.

CLAUSE – 23: Patents and Royalties

The bidder, if licensed under any patent covering equipment, machinery, materials or compositions of matter to be used or supplied or methods and process to be practiced or employed in the performance of this contract, agrees to pay all royalties and license fees which may be due with respect thereto. If any equipment, machinery, materials composition of matters, to be used or supplied or methods and processes to be practiced or employed in the performance of this contract, is covered by a patent under which the bidder is not licensed then the bidder before supplying or using the equipment, machinery, materials, composition method or processes shall obtain such licenses and pay such royalties and license fees as may be necessary for performance of this contract. In the event the bidder fails to pay any such royalty or obtain any such license, any suit for infringement of such patents which is brought against the bidder or the AMC as a result of such failure will be defended by the bidder at his own expense and the bidder will pay any damages and costs awarded in such suit if any solely by the bidder.

The bidder shall promptly notify the AMC if the bidder has acquired knowledge of any plant tender which a suit for infringement could be reasonably brought because of the use by the AMC of any equipment, machinery, materials, process, methods to be supplied here under. The bidder agrees to and does hereby grant to AMC , together with the right to extend the same to any of the subsidiaries of the AMC as irrevocable,



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royalty-free license to use in any country, any invention made by the bidder or his employee in or as a result of the performance of the work under the contract.

With respect to any sub-contract entered into by bidder pursuant to the provisions of the relevant clause hereof, the bidder shall obtain from the sub-bidder an undertaking to provide the AMC with the same patent protection that bidder is required to provide under the provisions of this clause.

CLAUSE – 24: Liens

If, at any time, there should be evidence or any lien or claim for which the AMC might have become liable and which is chargeable to the bidder, the AMC shall have the right to retain out of any payment then due or thereafter to become due an amount sufficient to completely indemnify the AMC against such lien or claim and if such lien or claim be valid the AMC may pay and discharge the same and deduct the amount so paid from any money which may be or may become due and payable to the bidder. If any lien or claim remains unsettled after all payments are made, the bidder

shall refund and make it good to the AMC or pay to the AMC all money that the latter may be compelled to pay in discharging such lien or claim including all costs and reasonable expenses.

CLAUSE – 25: PERFORMANCE OF WORK

CLAUSE - 25.1: Execution of Work

All the works shall be executed in strict conformity with the provisions of the contract document and with such explanatory detailed drawings, specifications and instructions as may be furnished from time to time to the bidder by the AMC &/or its authorized persons including Engineer-in-Charge whether mentioned in the contract or not. The bidder shall be responsible for ensuring that works throughout are executed in the most substantial, proper and workman like manner with the quality of material and workmanship in strict accordance with the specifications of the items mentioned in the tender.

CLAUSE – 25.2 : Work in Monsoon and Dewatering

The completion of the work may entail working in the monsoon also. The bidder must maintain a minimum labor force as may be required for the job and plan and execute the construction and erection according to the prescribed schedule. No extra rate will be considered for such work in monsoon.



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During monsoon and other period, it, shall be the responsibility of the bidder to keep the construction work site free from water at his own cost.

CLAUSE – 25.3: General Conditions for Construction and Erection work

The Working time at the time of work is 48 hours per week. Shift working in maximum 2 shifts per day will be allowed and the bidder should take this aspect into consideration for formulating his rates for quotation. No extra claims will be entertained by the AMC on this account.

The bidder must arrange for the placement of workers in such a way that the delayed completion of the work or any part thereof for any reason whatsoever will not affect their proper employment. The AMC will not entertain any claim for idle time payment whatsoever.

CLAUSE – 26: Setting out Works

The bidder shall be shown only the main boundaries of the work site and a level bench mark and the bidder shall set out the works and shall provide an efficient staff for the purpose and shall be solely responsible for the accuracy of such setting out.

The bidder shall provide, fix and be responsible for the maintenance of all stakes, templates, level marks, profiles and other similar things and shall take all necessary precautions to prevent their removal or disturbance and shall be responsible for the consequence of such removal or disturbance should the same take place and for their efficient and timely reinstatement. The bidder shall also be responsible for the maintenance of all existing survey marks, boundary marks, distance marks and central line marks, either existing or supplied and fixed by the bidder. The work shall be set out as per the details shown in the drawings.

Before beginning the works, the bidder shall at his own cost, provide all necessary reference and level posts, pegs, bamboos, flags, ranging rods, strings, and other materials for proper layout of the work in accordance with the scheme for bearing marks. The center, longitudinal or face lines and cross lines shall be marked by means of small masonry pillars. Each pillar shall have distinct mark at the center to enable theologist to be set over it. The bidder shall also provide all labor, material and other facilities, as necessary for the proper checking of layout and inspection of the points during construction.



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Pillars bearing geodetic marks located at the sites of units of works under construction should be protected and fenced by the bidder. On completion of works, the bidder must submit the geodetic documents according to which the work was carried out.

CLAUSE – 27: Responsibility for Level and Alignment

The bidder shall be entirely and exclusively responsible for the horizontal and vertical alignment, the levels and correctness of every part of the work and shall rectify effectively any errors or imperfections therein. Such rectification shall be carried out by the bidder at his own cost.

CLAUSE – 28: Materials to be Supplied by Bidder

The bidder shall procure and provide the whole of the materials of such quality and specifications as suggested by the AMC and required for the construction including M. S. Rods, cement and other building material, tools, tackles, construction plant and equipment for the completion and maintenance of the works and shall make his own arrangement for procuring such materials and for the transport thereof.

CLAUSE – 29: Material Procured with Assistance of AMC

No material shall be procured with assistance of AMC or shall be supplied by AMC.

CLAUSE – 30: Materials obtained from Dismantling

If the bidder in the course or execution of the work is called upon to dismantle any part for reasons other than those stipulated in clauses hereunder the materials obtained in the work of dismantling etc, will be informed and disposed off in consultation with AMC.

CLAUSE – 31: Articles of Value Found

All gold, silver and other minerals of any description and all precious stones, coins, treasure, relics, antiquities and other similar things which shall be found in under or upon the site shall be the property of the AMC and the bidder shall duly preserve the same.

**CLAUSE – 32: Discrepancies between Instructions**

Should any discrepancy occur between the various instructions furnished to the bidder, his agents or staff or any doubt arise as to the meaning of any such instructions or should there be any misunderstanding between the bidder's staff and the AMC&/or its authorized persons including Engineer-in-Charge's staff, the bidder shall refer the matter immediately in writing to the AMC&/or its authorized persons including Engineer-in-Charge whose decision thereon shall be final and conclusive and no claim for losses alleged to have been caused by such discrepancies between instructions, doubts, or misunderstanding shall in any event be admissible.

CLAUSE – 33: Alterations in work**CLAUSE – 33.1:**

The Engineers of AMC shall have the power to make any alterations in addition to the original specifications, drawings, designs and instructions that may appear to him to be necessary or advisable during the progress of the work and the bidder shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Engineer – In – Charge and such alternation shall not invalidate the contract and any additional work which the bidder may be directed to do in the manner above specified as part of the work shall be carried out by the bidder on the same conditions in all respects on which he agreed to do the main work and at the same rate as are specified in the tender for the main work.

CLAUSE – 33.2:

When the quantity of any item is increased than the quantity as specified in the tender, the bidder shall consult with the Engineers of AMC and if found appropriate the work shall be done. The bidder shall be paid for the same at the rates specified in the Schedule of Rates in the financial bid document of the tender.

CLAUSE – 34: Action where no specification is issued

In case of any class or work for which there is no such specification supplied by the AMC as is mentioned in the tender documents such work shall be carried out in accordance with Indian Standard Specifications and if the Indian Standard Specifications do not cover the same, the work should be carried out as per standard engineering practice.



CLAUSE – 35: Assistance to the Engineer

The bidder shall arrange for all necessary field instruments and assistance in checking of setting out of works and taking measurements of work.

CLAUSE – 36: Tests for Quality of Works

All workmanship shall be of the respective kinds described in the contract documents and shall be subjected from time to time to such test at bidder's cost as may be directed at the place of manufacturer or fabrication or on the site or at all or any such places. The bidder shall provide assistance, instruments, labor and material as are normally required for examining, measuring and testing any workmanship as may be selected and required. All the tests that will be necessary in connection with the execution of the work shall be carried out at such laboratory as may be prescribed by the AMC and actual expenses incurred thereto shall be borne by the bidder.

CLAUSE – 37: Possession Prior to Completion

The AMC shall have the right to take possession of or use any completed or partially completed work or part of the work. Such possession or use shall not be deemed to be an acceptance of any work completed in accordance with the contract agreement.

Five years shall be the period of liability from the date of Issue of Completion Certificate.

The bidder shall guarantee the installation/work for a period of five years from the date of issue of completion certificate. Any damage or defect that may arise or lie undiscovered at the time of issue of completion certificate, or within the said period, or connected in any way with the equipment or materials supplied by him or in the workmanship, shall be rectified or replaced by the bidder at his own expense. The AMC may cause the same to be made good by other workman and deduct expenses for which the certificate of AMC shall be final from any sums that may be then or at any time thereafter, become due to the bidder or from his security deposit, or the proceeds of sale thereof or of sufficient portion thereof.

CLAUSE – 38: Care of Works:

From the commencement to completion of the works, the bidder shall take full responsibility for the care for all works including all temporary works and in case any damages, loss or injury shall happen to the works or to any part thereof or to any temporary works from any cause whatsoever shall at his own cost repair and make good the same-so that at completion the work shall be in good order and in conformity in every respects with the requirements of the contract.



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CLAUSE – 39: Defects Prior to taking over

If at any time, before the work is taken over, the AMC shall:

- a) Decide that any work done or materials used by the bidder or any sub-bidder is defective or not in accordance with the contract, or that the works or any portion thereof are defective or do not fulfill the requirements of contract the all such matters being hereinafter, called 'Defects' in this clause, and
- b) as soon as reasonably practicable gives to the bidder notice in writing of the said decision, specifying particulars of the defects alleged to exist or to have occurred, then the bidder shall at his own expense and with all speed make good the defects so specified.

CLAUSE – 40: Defects after taking over

In order that the bidder could obtain a completion certificate he shall make good with all possible speed any defect arising from the defective materials supplied by the bidder or workmanship or any act of omission of the contract or that may have been noticed or developed after the work or group of works has been taken over. The period allowed for carrying out such work will be normally one month.

CLAUSE – 41: CERTIFICATES AND PAYMENTS

41.1 - Schedule of Rates and Payments

i) Schedule of Rates to be Inclusive

The prices/rates quoted by the bidder shall remain firm till the issue of final certificate and shall not be subject to escalation. Schedule of rates shall be deemed to include and complete, the works. The bidder shall be deemed to have known the nature, scope, magnitude and the extent of the works and materials required though the contract document may not fully and precisely furnish them. He shall make such provision in the schedule of rates, as he may consider necessary to cover the cost of such items of work and materials as may be reasonable and necessary.

Generality of this present provision shall not be deemed to cut down or limited in any way because in certain cases it may and in other cases it may not be expressly stated that the bidder shall do or perform a work or supply articles or perform services at his own cost or without addition of payment or without extra charge or words to the same effect or that it may be stated or not stated that the same are included in and covered by the schedule of rates.



ii) Schedule of Rates to Cover Constructional Plant, Materials, Labor etc.

Without in any way limiting the provisions of the preceding sub-clause the schedule of rates shall be deemed to include and cover the cost of all constructional plant, temporary work except as provided for therein) pumps, materials, labor insurance, fuel, stores, and appliances to be supplied by the bidder and all other matters in connection with each item in the schedule of rates and the execution of the works or any portion thereof finished, complete in every respect and maintained as shown or described in the contract documents or as may be ordered in writing during the continuance of the contract.

iii) Schedule of Rates to Cover Royalties, Rents and Claims:

The schedule of rates shall be deemed to include and cover the cost of all royalties and fees for the materials, articles and processes, protected by letters, patent or otherwise incorporated in or used in connection with the works, also all royalties, rents and other payments in connection with obtaining materials of whatsoever kind for the works and shall include an indemnity to the AMC which the bidder hereby gives against all actions, proceedings, claims damages, costs and expenses arising from the AMC in or use on the works of any such articles, processes or materials. Other local board charges if levied on materials, equipment or machinery to be brought to site for use on work shall be borne by the bidder.

iv) Schedule of Rates to Cover Taxes and Duties

In this tender is quoted by bidder without GST. GST applicable shall be extra and not included in the tender amount.

v) Schedule of Rates to Cover Risks of Delay

The schedule of rates shall be deemed to include and cover the risk of all possibilities of delay and interference with the bidder's conduct of work which occur from any cause including orders of the AMC in the exercise of his powers and on account of extension of time granted due to various reasons and for all other possible or probable causes of delay.

vi) Schedule of Rates to Cover Cost of Project Vehicle:

One Four Wheel Vehicle of Model 2017 or later, with AC shall be provided to the employee of AMC for Site Supervision work. However, this shall be provided by the Contractor after EC is issued to the AMC and the Construction work of the project has started.

One Four Wheel Vehicle of Model 2017 or later, with AC shall be provided to the employee of AMC for Site Supervision work. However, this shall be provided by the Contractor after EC is issued to the AMC or the Construction work of the project has started and till the completion period of the work. The Cost of running, maintenance, fuel, driver salary, insurance with sole responsibility etc. complete shall be borne by the bidder. The vehicle shall be required anywhere and at the site



of project of solid waste management for the use at Landfill site/Solid waste management department office. The vehicle shall run throughout the period of contract. The vehicle must be handed over to AMC within 15 days from the issue of the work order till the completion period of the work. Penalty at the rate of Rs. 1000 per day/Rs. 24000 per month shall be imposed and deducted from RA Bills of the bidder if the vehicle is not provided to AMC. The vehicle shall be required for to and fro travel between any places in Ahmedabad to any place in Ahmedabad or as required by AMC.

vii) Schedule of Rates Cannot be Altered

For work under unit rate basis, no alteration will be allowed in the schedule of rates except as provided in any other clause of this contract by reason of works or any part of them being modified altered, extended, diminished or omitted. The schedule of rates are fully inclusive rates which have been fixed by the bidder and agreed to by the AMC and cannot be altered.

41.2 - Procedure For Measurement/Billing of Work in Progress**i) Measurements**

All measurements shall be in metric system. All the works in progress will be jointly measured by the representative of the AMC&/or its authorized persons including Engineer-in-Charge and the bidder's authorized agent progressively. Such measurement will be got recorded in the measurement book by the AMC&/or its authorized persons including Engineer-in-Charge and signed in token of acceptance by the bidder or his authorized representative.

For the purpose of taking joint measurement the bidder's representative shall be bound to be present whenever required by the AMC&/or its authorized persons including Engineer-in-Charge. If however he absents for any reason whatsoever the measurements will be taken by the AMC&/or its authorized persons including Engineer-in-Charge and this will be deemed to be correct and binding on the bidder.

ii) Billing

The bidder will submit a bill in approved Performa to the AMC of the work giving abstract and detailed measurements for the various items executed during a month, before expiry of the 1st week of the succeeding month. AMC shall verify the same to ensure that the quantities billed for are strictly for the quantities of all the items as jointly measured and recorded by consultants and or authorized representatives of the AMC and arrange for payment. Payment shall be made in the specified time period of AMC after the bill is duly checked, certified and verified by the AMC.



iii) Secured Advance on Materials

In case of tenders for completed item of work, bidder shall not be allowed any type of "Secured Advance" on the security of materials brought to site for execution of the contracted item of work.

iv) Dispute in Mode of Measurement

In case of any dispute as to the mode of measurement not covered by the contract to be adopted for any item of work, mode of measurement as per latest Indian Standard Specifications shall be followed.

41.3 - Lump Sums in Tender

For the item in tender where it includes lump-sum in respect of parts of work, the bidder shall be entitled to payment in respect of the items at the same rates as are payable under this contract for such items, or if the part of the work in question is not in the opinion of the AMC capable of measurement or determination, the AMC may at its discretion pay the lump-sum amount entered in the tender or a percentage thereof.

41.4 - Payments Running Account to be Regarded as Advance

All running account payments shall be regarded as payments by way of advance against the final payment only and not as payments for work actually done and completed and shall not preclude the requiring of bad, unsound and imperfect or unskilled work to be removed and taken away and reconstructed or re-erected or be considered as an admission of the due performance of the contract, or any part thereof, in tills respect, or of the accruing of any claim by the bidder, nor shall it conclude, determine or affect in any way the powers of the AMC under these conditions or any then as to the final settlement and adjustment of the accounts or otherwise, or in any other way vary or affect the contract. The final bill shall be submitted by the bidder within one month of the date of physical completion of the work.

41.5 - Notice of Claims for Additional Payments

Should the bidder consider that he is entitled to any extra payment or compensation or to make any claims whatsoever in respect of the works shall intimate AMC that he claims extra payment and/or compensation. Such notice shall be given



to the AMC within ten days from the ordering of any work or happening of any event upon, which the bidder bases such claims and such notice shall contain full particulars of the nature of such claim with full details and amount claimed. Failure on the part of the bidder to put forward any claim with the necessary particulars as above within the time above specified shall be an absolute waiver thereof. No omission by the AMC to reject any such claim and no delay in dealing therewith shall be waiver by the AMC of any rights in respect thereof.

41.6 - Payment of Contractor's Bill

The bill should be raised on monthly basis and no payment shall be made for works estimated to cost less than Rs. 100 lakhs till the whole of the work shall have been completed and a certificate of completion. But in case of works estimated to cost more than Rs. 100 lakhs, the contractor on submitting the bill there of be entitled to receive a monthly payment proportionate to the part thereof approved and passed by the AMC. This payment will be made after making necessary deductions as stipulated elsewhere in the contract document for materials, security deposit etc.

Payment due to the contractor shall be made by the Corporation by Crossed Account Payee cheque or through Electronic Clearing System (by NEFT/RTGS) forwarding the same to registered office or the notified office of the contractor or if paid through ECS shall be deposited in the contractor's account. In no case will Corporation be responsible if the cheque is mislaid or misappropriated by unauthorized person/ persons. In all cases, the contractor shall present his bill duly pre receipted on proper revenue stamp.

All payments shall be made in Indian currency.

41.7 - Receipt for Payment

Receipt for payment made on account of work executed by a firm must be signed by an authorized person of the bidder, except when the bidders are described in their tender as a limited AMC in which case the receipts must be signed in the name of the AMC by one of its principal officers or by some other person having authority or give effectual receipt for the AMC. Receipt for payment made on account of work executed by a firm must be.

41.8 - Completion Certificate

41.8.1 - Application for Completion Certificate

When the bidder fulfils his obligation under the relevant clause, he shall be eligible to apply for completion certificate. The bidder may apply for



separate completion certificate in respect of such portion of the work by submitting the completion documents along with such application for completion certificate.

The AMC shall normally issue to the bidder the completion certificate within stipulated time after receiving an application from the bidder and after verifying the completion documents and satisfying himself that the work has been completed in accordance with and as set out in the construction and erection drawings, and the contract documents. The bidder, after obtaining the completion certificate, is eligible to present the final bill for the work executed by him under, the terms of contract.

41.8.2 - Completion Certificate

Within one month of the completion of the work in all respects, the bidder shall be furnished with a certificate by the AMC of such completion but neither certificate shall be given nor shall the work be deemed to have been completed until all scaffolding, surplus materials and rubbish is cleaned off the site completely and until the work shall have been measured by the AMC whose measurement shall be binding and conclusive. The work will not be considered as complete and taken over by the AMC, until all the temporary work, labor and staff colonies etc., constructed, are removed and the work site cleaned.

If the bidder shall fail to comply with the requirements of this clause on or before the date fixed for the completion of the work, the AMC&/or its authorized persons including Engineer-in-Charge may at the expenses of the bidder remove such scaffolding, surplus materials and rubbish and dispose of the same as he thinks fit and clear off such dirt as aforesaid, and the bidder shall forthwith pay the amount of all expenses so incurred and shall have no claim in respect of any such scaffolding or materials as aforesaid.

41.8.3 - Completion Certificate Documents

Following documents will be deemed to form the completion documents:

- i) The technical documents according to which the work was carried out.
- ii) Three sets of construction drawings showing therein the modification and corrections made during the course of execution.
- iii) Completion certificate for 'embedded' and 'covered' up works.
- iv) Certificates of final levels as set out for various works.
- v) Certificates of tests performed for various works.

**CLAUSE – 42: TAXES AND INSURANCE****42.1 - Taxes, Duties etc.**

The bidder agrees to and does hereby accept full and exclusive liability for the payment of any and all types of taxes, duties, royalties, octroi etc. now or hereafter imposed, increased, or modified, and all the duties etc. now in force and hereafter increased, imposed, or modified from time to time in respect of works and materials and all contributions and taxes for unemployment compensation, insurance and old age pensions or annuities now or hereafter imposed by any Central or State Governmental authorities which are imposed with respect to or covered by the wages, salaries, or other compensations paid to the persons employed by the bidder and the bidder shall be responsible for the compliance with all obligations and restrictions imposed by the labor law as may be applicable to the bidder and the AMC or any other law affecting employer-employee relationship and the bidder further agrees to comply, and to secure the compliance of all sub-bidders, with all applicable Central, State, municipal and local laws and regulations and requirements of any Central, State or Local Government agency or authority

Bidder further agrees to defend, indemnify and hold harmless from any liability or penalty which may be imposed by the Central, State or Local authorities by reason of any violation by bidder or sub-bidder of such laws, regulations or requirements and also from all claims, suits or proceedings that may be brought against the AMC arising under, growing out of, or by reason of the work provided for by this contract, by third parties, or by Central or State Government authority or any administrative sub-division thereof.

42.2 - Insurance

Bidder shall at his own expense cover and maintain insurance with reputable insurance companies to the satisfaction of the AMC as follows:

42.3 - Employees State Insurance Act

The bidder agrees to and does hereby accept full and exclusive liability for the compliance with all obligations imposed by the Employees State Insurance Act, 1948, and the bidder further agrees to defend, indemnify and hold AMC harmless from any liability or penalty which may be imposed by the Central, State or Local authority by reason of any asserted violation by bidder or sub bidder of the Employees' State Insurance Act, 1948 and also from all claims, suits or proceeding that may be brought against the AMC arising under, growing out of or by reasons of the work provided for by this contract whether brought by employees of the bidder, by third parties or by Central or State Government authority or any political sub-division thereof.



The bidder further agrees and undertake to comply with due procedure of law including drilling and filing of various forms, returns, documents etc. with the concerned department of the government with in prescribed time and deposit the contribution there under with in a prescribed time.

The bidder agrees to fill in with the Employee's State Insurance AMC, the declaration forms, and all forms which may be required in respect of the bidder's or sub bidder's employees who are employed in the work provided for or those covered by ESI from time to time under the Agreement. The bidder shall deduct and secure the agreement of the sub bidder to deduct the employee's contribution as per the first schedule of the Employee's State Insurance Act from wages and affix the Employee's Contribution Cards at wages payment intervals. The bidder shall remit and secure the agreement of the sub-bidder to remit to the State Bank of India Employee's State Insurance AMC Account, the Employees' contribution as required by the Act. The bidder agree to maintain all Card and records as required under the Act in respect of employees and payments, and the bidder shall secure the agreement of the sub-bidder to maintain such records. Any expenses inclined for the contribution, making contributions or maintaining records shall be to the bidder's or sub-bidder's account.

The AMC shall retain such sum as may be necessary form the total contract value unit the bidder shall furnish satisfactory proof that all contribution as required by the Employees State Insurance Act, 1948, has been paid.

42.4 - Workman's Compensation and Employer's Liability Insurance

Before undertaking the work relating to this project the bidder agrees and undertake to submit a copy of the insurance policy taken under the Workman's Compensation Act 1923 and bidder should ensure that it has been properly covered both in number of employees and type of employment i.e. skill, semiskilled and unskilled workers. Insurance shall be affected for all the bidder's employees engaged in the performance of his contract: If any of the work is sublet, the bidder shall require the sub-bidder to provide Workman's Compensation and employer's liability insurance for the tatter's employees of such employees are not covered under the bidders Insurance. The bidder should also insure his personnel under the personal accident cover policy if required.

42.5 - Any other Insurance required under any Law or Regulation

Bidder shall also ensure to carry and maintain all other insurance policies which he may be required under any law or regulation from time to time. He shall also carry and maintain any other insurance as may be required by the AMC.

**42.6 - Damage to Property**

- i) Bidder shall be responsible for making good to the satisfaction of the AMC any loss and any damage to all structures and properties belonging to the AMC or being executed or procured by the AMC or of other agencies within the premises of all the work of the AMC, if such loss or damage is due to fault and/or the negligence or willful acts or omission of the bidder, his employees, agents, representatives or sub-bidders.
- ii) The bidder shall indemnify and keep the AMC harmless of all claims for damage to property other than AMC's property arising under or by reason of this agreement if such claims result from the fault and/or negligence or willful acts or omissions of the bidder, his employees, agents, representative or sub-bidders.
- iii) The AMC shall have no liability towards the accident occurred if any, to any person involved in carrying out the work relating to project or while handling, loading, unloading, carrying, dumping, excavating etc. of any material and for the loss, damage etc. occurred to the vehicle indulged in such handling or carrying the material and it shall be the total responsibility of the bidder to compensate the same and meet with all statutory liabilities arising there from.

CLAUSE – 43: LABOUR LAWS AND SAFETY REGULATIONS**43.1 - Labor Laws**

No labor below the age of fifteen years shall be employed on the work. The bidder shall not pay less than what is provided under law to laborers engaged by him on the work. The bidder shall at his expense comply with all labor laws as applicable and keep the AMC indemnified in respect thereof. The bidder shall ensure to AMC with various provisions of labor laws as may be applicable to them.

43.2 - Bidder to Indemnify the AMC

i) The bidder shall indemnify the AMC and every member, officer and employee of the AMC , also the AMC&/or its authorized persons including Engineer-in-Charge and his staff against all actions, proceedings, claims, demands, costs and expenses whatsoever arising out of or in connection with the matters referred to and elsewhere and all actions, proceedings, claims, demands, costs and expenses which may be made against the AMC for or in respect of or arising out of any failure by the bidder in the performance of his obligations under the contract documents. The AMC shall not be liable, for or in respect of any demand or compensation payable under any law in respect or in consequence of any accident or injury to any workmen or other person in the employment of the bidder or his sub-bidder and bidder shall indemnify and keep indemnified the AMC against all such damages, and compensations and against all claims, damages, proceedings, costs, charges and expenses whatsoever in respect thereof or in relation thereto.

**ii) Payment of Claims and Damages**

Should the AMC have to pay any money in respect of such -claims or demands as aforesaid the amount so paid and the costs incurred by, the AMC shall be charged to and paid by the bidder and the bidder shall not be at liberty to dispute or question the right of the AMC to make such payments notwithstanding the same may have been made without his consent, or authority or in law or otherwise to the contrary.

iii) In every case in which by virtue of the provisions of section 12, sub-section (i) of workmen's compensation act, 1923 or other applicable provision of Workmen's Compensation Act or any other Act, the AMC is obliged to pay compensation to a workman, employed by the bidder in execution of the works, the AMC will recover from the bidder the amount of the compensation so paid, and without prejudice to the rights of AMC under section 12, sub-section (2) of the said Act, AMC shall be at liberty to recover such amount or any part thereof by deducting it from the security deposit or from any sum due to the bidder whether under this contract or otherwise. The AMC shall not be bound to contest any claim made under section 12 sub-section (1) of the said Act, except on the written receipt of the bidder and upon his giving to the AMC full security for all costs for which the AMC might become liable in consequence of contesting such claim.

43.3 - Health and Sanitary Arrangements for Workers

In respect of all labor directly or indirectly employed in the works for the performance of the bidders part of this agreement, the bidder shall comply with or cause to be complied with all the rules and regulations of the local sanitary and other authorities or by the AMC from time to time for the protection of health and sanitary arrangements for all the workers.

43.4 - Safety Regulations

- (i) In respect of all labor, directly or indirectly employed in the work for the performance of bidder's part of this agreement, the bidder shall at his own expense arrange for all the safety provisions as per safety codes of C.P.W.D., Indian Standards Institution, The electricity Act, The Mines Act and such other acts as applicable.
- (ii) The bidder shall observe and abide by all fire and safety regulations of the AMC. Before starting construction work bidder shall consult with AMC's and must make good to the satisfaction of the AMC any loss or damage due to fire to any portion of the work done or to be done under this agreement or for any of the AMC 's existing property.

43.5 - Jurisdiction

The contract shall be governed by and constructed according to the laws in force in India. In case of dispute or differences arising relating to interpretation, construction and or implementation of any clause relating to this tender document, same shall be referred to the arbitrator appointed by the AMC and whose decision shall remain final, conclusive and binding for both the parties.



43.6 - SAFETYCODE

43.6.1 - General

Bidder shall adhere to safe construction practice and guard against Municipal and unsafe-working conditions and shall comply with AMC's safety rules as set forth herein.

43.6.2 - First Aid and Industrial Injuries

- 1) Bidder shall maintain, first aid facilities for its employees and those of its sub bidders.
- 2) Bidder shall make outside arrangements for ambulance service and for the treatment of industrial injuries. Names of those providing this service shall be furnished to AMC prior to start of construction and their telephone numbers shall be prominently posted in Bidder's field office.
- 3) All critical injuries shall be reported promptly to AMC and a copy of bidder's report covering each personal injury requiring the attention of a physician shall be furnished to the AMC.

43.6.3 - General Rules

Smoking within the battery area, tank farm or dock limits is strictly prohibited. Violators or the no smoking rules shall be discharged immediately.

43.6.4 - Bidder's Barricades

- (1) Bidder shall erect and maintain barricades required in connection, with his operation to guard or protect.
 - (a) Excavations.
 - (b) Hoisting areas
 - (c) Area adjudged Municipal by Bidder's, or AMC's inspectors
 - (d) AMC 's existing property subject to damage by Bidder's Operations
 - (d) Rail road unloading spots.
- (2) Bidder's employees shall become acquainted with AMC's barricading practice and shall respect the provisions thereof.
- (3) Barricades and Municipal areas adjacent to but not located in normal routes of travel shall be marked by red flasher lanterns at nights

43.6.5 - Scaffolding

- (i) **Suitable** scaffoldings should be provided for workmen for all woks that cannot safely be done from the ground or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra worker shall be engaged for holding the ladder and if the a ladder is used for carrying materials, as well, suitable footholds and handholds shall be



provided on the ladder and the ladder shall be given an inclination not steeper than 1 in 4 (1 horizontal and 4 vertical).

(ii) Scaffolding or staging more than 4 meters above the ground or floor, swing suspended from an overhead support or erected with stationary support shall have a guard rail properly attached, bolted, braced and otherwise rewarded at least 3 ft. high above the floor or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such openings as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying the building or structure.

(iii) Working platform, gangways and stairways should be so constructed that they should not sag unduly or unequally and if the height of the platform of the gangway or the stairway is more than 4 meters above ground level or floor level, they should be closely boarded, should have adequate width and should be suitably fastened as described in (ii) above.

(iv) Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of persons or materials by providing suitable fencing or railing whose minimum height shall be 1 meter.

(v) Safe means of access shall be provided to all working platforms and other working places, every ladder shall be securely fixed. No portable single ladder shall be over 9 meters in length while the width between side rails in rung ladder shall in no case be less than 30 cm for ladder up to and including 3 meters in length. For longer ladder this width should be increased at least 5 mm for each additional foot of length. Uniform steps spacing shall not exceed 30 cm. Adequate precautions shall be taken to prevent danger from electric equipment. No materials on any of the sites of work shall be so stacked or placed to cause danger or inconvenience to any person or public. The bidder shall also provide all necessary fencing and lights to protect the workers and staff from accidents, and shall be bound to bear the expenses of defense of every suit, action or other proceedings of law that may be brought by any person for injury sustained owing to neglect of the above precautions and pay any damages and costs which may be awarded in any such suit or action or proceedings to any such person or which may with the consent of the bidder be paid to compromise any claim by any such person.

43.6.6 - Excavation and Trenching

All trenches 1.2 meters or more in depth shall at all times be supplied with at least one ladder for each 50 meters length or fraction thereof.

Ladder shall be extended from bottom of the trench to at least 1 meter above the surface of the ground. The sides of the trenches which are 1.5 meters in depth shall be stepped back to give suitable slope or securely held by timber bracing so as to avoid the danger of sides to collapse. The excavated materials shall not be placed within 1.5 meters of the edge of the trench or half of



the trench width whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or under cutting shall be done.

CLAUSE – 44: PRICE VARIATION FOR CEMENT AND STEEL BROUGHT BY CONTRACTOR FOR PROJECT DURATION EXTENDING MORE THAN 12 MONTHS:

The amount payable to the contractor for the work done shall be adjusted for increase or decrease in the rates of cement & steel as under:

Price variation for cement and steel brought by the contractor

The star rates for cement, mild steel and TOR/TMT steel to be brought by the contractor shall be considered at site as per RBI indices for the month in which tender is invited:

Cement	Rs. 5234.00 per MT
Steel - TMT Steel Fe 500 Bars	Rs.59420.00per MT

(The above star rates shall be linked with Reserve Bank of India price index for steel and cement for the month in which the Tender shall be invited).

a) When basic rate is less than procurement rate

The fluctuations in rates of cement steel and structural steel shall be adjusted in the bills payable to the contractors as under:

$$A = B \times \left[\frac{CI}{CO} - 1 \right] \times D$$

A=Amount payable or recoverable

B=Star rate of steel / cement

CI=The (quarterly) average corresponding index for steel, cement for the quarter under consideration (as published in monthly bulletin of Reserve Bank of India).

CO=Price index of cement/steel for the month in which the tender documents are invited published in monthly bulletin of Reserve Bank of India.

D=Quantity of cement/steel actually brought by the contractor on site of work and consumed in the work during the quarter duly supported with bill as recorded in cement consumption register or MB (for steel).

a) When basic rate is greater than procurement rate

The difference between actual rate of purchase as per original bill and star rate given in above clause shall be recoverable for the quantity of cement and steel consumed in the work executed.

Conditions for variation in prices of cement and steel only:

1. No ceiling for escalation for difference of steel and cement will be applicable.
2. This clause shall be operative from the date of issue of work order and up to the expiry of original and extended time limit.
3. This formula shall be used individually for cement and steel for calculating adjustment.



VOLUME - 1

TECHNICAL BID DOCUMENT

AHMEDABAD MUNICIPAL CORPORATION (AMC), SWM DEPARTMENT

CONSTRUCTION OF SECURED LANDFILL PHASE 2 AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD FOR DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTE

4. The cement and steel brought by the contractor on site of work shall be used only after the same is tested by the Department at the cost of contractor or after production of test certificate by Manufacturer as desired by the authority.

If such materials are not found as per the IS specification, the same shall be removed by the contractor for which no claim shall be entertained.



SECTION – 16

ITEM WISE TECHNICAL SPECIFICATIONS OF CIVIL WORKS

The specifications described here given are covered in the Schedule of Rates. Relevant IS codes for all the works mentioned below, covering all building materials, proportions in which they are required to be mixed/prepared, procedure for making/laying/fixing of the materials, if any, shall be applicable and the works have to be done as per the specifications and guidelines mentioned therein with relevant tests carried out as specified of the prepared structure and all the materials used in the said work which should be noted and strictly followed as a part of quality assurance program in the construction work. Specifications for general items covered in construction of different components of landfill are described here:

GENERAL

1. **Scope of Work**

The work contemplated under this contract includes General Construction for the aforesaid project, all as detailed in the Bill of Quantities, Specifications and Drawings.

Such other works which are not included in the aforesaid Bill of Quantities are generally intended to be executed through a separate agency. Not with-standing the above, the AMC reserve the right to order additional works under the same Contract. The AMC also reserve the right to omit any item of work included in the aforesaid Bill of Quantities or not perform it at all at their discretion and the Bidder shall not have any claim because of the same.

The Bidder for this work shall be required to work in co-operation and co-ordination with other agencies on site and give them all reasonable assistance and help for the execution of the work in an efficient manner as directed. The words "approved" or "as directed" shall be deemed to convey approval or the discretion of The Engineer.

2. **Indian Standard Specifications**

The particular Specifications for the work is as detailed hereinafter. The Specification shall be read in conjunction with the relevant Indian Standard Specifications and the obtainable local practice as detailed in various regional handbooks of practice and the work shall be executed accordingly. Where the Specifications in any of the standards are at variance with the Specifications detailed herein, the Specifications herein shall govern.

3. **Quality of materials & General Standards of work**

The Bidder under this contract commits himself to use first class material and assumes full responsibility for the quality of all material incorporated or brought for in AMC in the work. The work shall be executed in accordance with best engineering practice and as per directions of the Engineer.



4. Water and Power for construction

Please refer relevant clauses under "Special Conditions of the Contract".

5. Scaffolding

All scaffolding and ladders required for the proper execution of the work shall be provided by the Bidder.

Measurements

The mode of measurements, wherever possible is specifically mentioned in these documents, where it has not been mentioned, it shall be as per provisions of the relevant Indian Standards. All the measuring tapes and other accessories necessary, shall be provided by the Bidder.

6. Tools and Plant

The bidder along with tender shall furnish a list of tools, plant and machinery which he intends to use on the works. The list should indicate the exact type of machine, its capacity, year of manufacture, kind and capacity of propelling force, spare parts readily available and all other pertinent information. The bidder is obliged to use all the machinery mentioned in his list if the Engineer considers in necessary.

7. Surveying and staking

It is the express responsibility of the Bidder to bring to site all surveying instruments necessary for the marking out, fixation of levels, etc. and conduct these survey operations himself with utmost accuracy. The Bidder shall put up stable stakes, benchmarks etc. as necessary for the work. The Engineer will be present when this work is being carried out and will inspect all these operations with the Bidder's assistance.

8. Dewatering

Dewatering of all accumulated water in all locations on job site from whatever source or cause until the completion of the entire work, shall be done by the bidder at his own expense and shall not be separately paid for. The rates quoted by the bidder shall be deemed to be inclusive of this.

9. Access to site, approach roads and roads within the premises.

The bidder shall at his own cost provide all approach roads required in connection with the access to site for transport of materials and labor and such other uses. He shall acquaint himself thoroughly regarding condition and suitability of public roads leading up to the limits of the premises and will provide vehicles for transportation of materials which meet the requirements of these road conditions. It shall also be the responsibility of the bidder to maintain at his own cost these roads till the construction is completed.



Item No. 01: Mass Excavation in all sorts of soil including soft and hard soil with side slope in 1:2.0 (V:H) from existing ground level (Average EGL – 42.50 RL) to the specified depth from the EGL as well as vertical excavation at the bottom most part of the phase for 1.20 m depth for incorporating bottom liners:

Excavation of the earthen tank shall be carried out in all sorts of soil from average existing ground level of 42.50 RL to an average depth of 15.70 m from existing GL (EGL- 42.50 RL) in the specified slope of 1:2.0 (V:H) in accordance with the drawing supplied by the corporation. The depth at the ramp and leachate collection tank side shall be maintained at 17.90 m from the EGL, whereas that on the opposite side shall be maintained at 13.50 m from the corresponding EGL on that side. The remaining slope height shall be governed by the overall depth at the specific location as indicated in the drawing. The bottom of the phase shall be uniformly leveled. The work includes excavation, filling and transportation as well as dumping of the soil obtained from excavation within the total site area for further future use or disposal outside the site as instructed by the Engineer – in – charge up to a lead of 2 km within the site. The excavated soil should be dumped in such a way in the site area that it shall be easily usable for other works or be disposed off outside the site (For outside site disposal, the lead shall be 5 km).

Vertical excavation of 1.20 m depth shall be done once the bottom level as specified is reached to incorporate the bottom liner system. There is a slope along the lengths side and the width side of the phase to be maintained at the bottom level of the phase as mentioned in the drawing to allow the leachate to flow from the higher side to the leachate collection tank side. Moreover, the central line of the bottom shall be at the lowest level and levels at the sides of the bottom shall be at highest level width wise for the leachate to flow easily into the leachate collection pipes. After maintaining in the specified bottom slope, the vertical excavation as indicated for incorporation of the bottom liners and drainage layer shall be done in the same slope.

The excavation shall be measured as per the exact length, width and depth according to the instruction of the AMC&/or its authorized persons including Engineer - in - charge. The depth of the tank shall be measured from the existing ground level of 42.5 RL. The rate of excavation includes de watering whenever required at the site. Any extra precaution required for excavation shall be taken in accordance with the instruction given by the AMC&/or its authorized persons including Engineer - in - charge. It may include use of normal excavator machines for earthwork.

1: GENERAL PROCEDURE AND SPECIFICATIONS FOR MASS EXCAVATION AND EARTH WORK:

1.1. Applicable Codes

The following Indian Standard Codes, unless otherwise specified herein, shall be applicable. In all cases, the latest editions including all applicable official amendments and revisions shall be referred to.

**VOLUME - 1****TECHNICAL BID DOCUMENT****AHMEDABAD MUNICIPAL CORPORATION (AMC), SWM DEPARTMENT****CONSTRUCTION OF SECURED LANDFILL PHASE 2 AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD FOR DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTE**

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|----|-----------|---|--|
| a) | IS 3764 | - | Excavation work - Code of Safety. |
| b) | IS 2720 | - | Methods of test for soils: |
| | (Part-1) | - | Preparation of dry soil samples for various tests. |
| | (Part-2) | - | Determination of Water Content. |
| | (Part-4) | - | Grain size analysis. |
| | (Part-5) | - | Determination of liquid and plastic limit. |
| | (Part-7) | - | Determination of water content - dry density relation using light compaction. |
| | (Part-8) | - | Determination of water content - dry density relation using heavy compaction. |
| | (Part-9) | - | Determination of dry density – moisture content by constant weight of soil method. |
| | (Part-14) | - | Determination of density index (relative density) of cohesionless soils. |
| | (Part-22) | - | Determination of organic matter. |
| | (Part-26) | - | Determination of pH Value. |
| | (Part-27) | - | Determination of total soluble sulfates. |
| | (Part-28) | - | Determination of dry density of soils in place, by the sand replacement method. |
| | (Part-33) | - | Determination of the density in place by the ring and water replacement method. |
| | (Part-34) | - | Determination of density of soil in place by rubber balloon method. |
| | (Part-38) | - | Compaction control test (Hilf Method). |

1.2. Excavation**1.2.1 General**

Excavation for trenches over areas and for pits, etc. shall be done to widths, lines and levels as shown in drawings or to such lesser or greater widths, lines and levels as directed. The bottom and sides of excavation shall be trimmed to required levels, profile, etc. watered and thoroughly rammed. Should any excavation be taken below the specified levels, the bidder shall at his own cost fill up such excavation with cement concrete (M-10) to required levels. Filling in such excavation with excavated material is prohibited.

All excavation work shall be carried out by mechanical equipment unless, in the opinion of Engineer, the work involved requires it to be carried out by manual methods.

1.2.2 Grubbing and Clearing

Before excavation is started, the area coming under cutting / excavation shall be thoroughly grubbed and cleared off shrubs, rank vegetation, grass, bush wood, debris, trees / sapling of girth upto 300 mm. The roots shall be removed up to depth of 600 mm below ground. The rubbish shall be removed outside the site as directed by the Engineer.

**1.2.3 Dewatering**

The Bidder shall ensure that the excavation and the structures are free from water during construction and shall take all necessary precautions and measures to exclude ground/rain water so as to enable the works to be carried out in reasonably dry conditions in accordance with the construction program. Sumps made for dewatering must be kept clear of the excavations/trenches required for further work. The method of pumping shall be approved by Engineer, but in any case, the pumping arrangement shall be such that there shall be no movement of subsoil or blowing in due to differential head of water during pumping. Pumping arrangements shall be adequate to ensure no delays in construction. The dewatering shall be continued for at least (7) seven days after the last pour of the concrete. The Bidder shall, however, ensure that no damage to the structure results on stopping of dewatering.

The Bidder shall study the sub-soil conditions carefully and shall conduct any tests necessary at the site with the approval of the Engineer to test the permeability and drainage conditions of the sub-soil for excavation, concreting etc., below ground level.

The scheme for dewatering and disposal of water shall be approved by the Engineer. The Bidder shall suitably divert the water obtained from dewatering from such areas of site where a buildup of water in the opinion of the Engineer obstructs the progress of the work, leads to insanitary conditions by stagnation, retards the speed of construction and is detrimental to the safety of men, materials, structures and equipment.

When there is a continuous inflow of water and the quantum of water to be handled is considered in the opinion of Engineer, to be large, a well point system- single stage or multistage, shall be adopted. The Bidder shall submit to the Engineer, details of his well point system including the stages, the spacing, number and diameter of well points, headers etc., and the number, capacity and location of pumps for approval.

Unless separately provided for in the Schedule of quantities, cost of dewatering is deemed to have been included in the unit rates quoted for excavation. If separately provided for, the unit of measurement shall be as indicated in the Schedule of Quantities.

1.2.4 Timbering to excavation (shoring)

Where the soil is soft and sides of excavation needs supporting, suitably designed planking and strutting shall be provided.

Close timbering shall be done by completely covering the sides of the trenches and pits generally with short, upright members called 'polling boards'. These shall be of minimum 25 cm x 4 cm sections or as approved by the Engineer. The boards shall generally be placed in position vertically side by side without any gap on each side of the excavation and shall be secured by horizontal wailings of strong wood at maximum 1.2 meter spacing, struttled with bellies or as approved by the Engineer. The length of the bellies struts shall depend on the width of the trench or pit. If the soil is very soft and loose, the boards shall be placed



horizontally against each side of the excavation and supported by vertical wallings, which in turn shall be suitably strutted. The lowest boards supporting the sides shall be taken into the ground and no portion of the vertical side of the trench or pit shall remain exposed, so as to render the earth liable to slip out.

Timber shoring shall be 'close' or 'open' type, depending on the nature of soil and the depth of pit or trench. The type of timbering shall be as approved by the Engineer. It shall be the responsibility of the Bidder to take all necessary steps to prevent the sides of excavations, trenches, pits, etc. from collapsing.

Timber shoring may also be required to keep the sides of excavations vertical to ensure safety of adjoining structures or to limit the slope of excavations, or due to space restrictions or for other reasons. Such shoring shall be carried out, except in an emergency, only under instructions from the Engineer.

The withdrawal of the timber shall be done carefully to prevent the collapse of the pit or trench. It shall be started at one end and proceeded with, systematically to the other end. Concrete or masonry shall not be damaged during the removal of the timber.

In the case of open timbering, the entire surface of the side of trench or pit is not required to be covered. The vertical boards of minimum 25 cm x 4 cm sections shall be spaced sufficiently apart to leave unsupported strips of maximum 50 cm average width. The detailed arrangement, sizes of the timber and the spacing shall be subject to the approval of the Engineer. In all other respects, the Specifications for close timbering shall apply to open timbering.

In case of large pits and open excavations, where shoring is required for securing safety of adjoining structures or for any other reasons and where the planking across sides of excavations/pits cannot be strutted against, suitable inclined struts supported on the excavated bed shall be provided. The load from such struts shall be suitably distributed on the bed to ensure no yielding of the strut. If however, Engineer directs any timbering to be left-in, keeping in mind the type of construction or any other factor, Bidder shall be paid for at the scheduled item rate for such left-in timbering.

Unless otherwise separately provided for in Schedule of Quantities, the timber shoring is deemed to have been included in the unit rates quoted for excavation. If separately provided for, then the actual effective area of shored faces as approved by Engineer shall be measured in Sq. m. The area of planking embedded in the bed/sides of excavation will not be considered, nor the area supporting inclined struts in case of large pits/open excavation. All planks, boards, wallings, verticals, struts, props and all other materials required for shoring and subsequent safe dismantling and removal shall be included in the quoted unit rates.

**1.2.5 Soil / Rock Classification****1.2.5.1 General**

All materials to be excavated shall be classified by Engineer, into one of the following classes and shall be paid for at the rate contracted for that particular class of material. No distinction shall be made whether the material is dry, moist or wet. The decision of Engineer regarding classification of the material shall be final and binding on bidder and not be a subject matter of any appeal or arbitration. Excavation shall be classified under one of the following categories by the Engineer.

a) Ordinary soft soil and Hard Soils

These shall include all kinds of soils containing kankar, sand, silt, murrum and/or shingle, gravel, clay, loam, peat, ash, shale etc. which can generally be excavated by spade, pick-axes and shovel and which is not classified under “soft and decomposed rock” and “hard rock” defined below. This shall also include embedded rock boulders not longer than 1 meter in any direction and not more than 200 mm in any one of the other two directions.

b) Hard Rock

This shall include all rock occurring in large continuous masses which cannot be removed except by blasting for loosening it. Hard varieties of rock with or without veins and secondary minerals which, in the opinion of Engineer require blasting shall be considered as hard rock. Boulders of rock occurring in such sizes and quality shall also be classified as hard rock. Concrete work both reinforced and unreinforced to be dismantled will be measured under this item unless a separate provision is made in the Schedule of Quantities.

c) Soft and Decomposed Rock

This shall include rock, boulders, slag, chalk, slate, hard mica schist, laterite, sand stone and all other materials which in the opinion of Engineer is rock but does not need blasting and could be removed with picks, hammer, crow bars, wedges and pneumatic breaking equipment. The mere fact that bidder resorts to blasting for reasons of his own, shall not qualify for classification under “hard rock”.

1.2.5.2 Stripping Loose Rock

All loose boulders, detached rocks partially and other loose material which might move therewith not directly in the excavation but so close to the area to be excavated as to be liable, in the opinion of Engineer, to fall or otherwise endanger the workmen, equipment, or the work shall be stripped off and removed from the area of the excavation. The method used shall be such as not to render unstable or unsafe the portion which was originally sound and safe.

Any material not requiring removal in order to complete the permanent works, but which, in the opinion of Engineer, is likely to become loose or unstable later, shall also be promptly



and satisfactorily removed. The cost of such stripping will be paid for at the unit rates accepted for the class of materials in question.

1.2.6 Blasting

Where blasting has to be resorted to for rock cutting it shall be the responsibility of the bidder to arrange for the following at his entire risk, cost and responsibility.

- a) Permission from all the connected Public Authorities such as Municipal Corporation, Nagarpalika, Gram Panchayat, Inspector of Explosives, Police, Highway Authorities, etc. shall be obtained.
- b) Fees, royalties and any other levies, attendant on such blasting work shall be entirely borne by the bidder.
- c) All precautionary measures such as notices to adjoining property and other agencies working in and around the plot, signaling and watch etc. shall strictly adhere to according to the various regulations in force.
- d) All risk Insurance in respect of the blasting hazards to men and materials within and in the vicinity of the plot. This insurance shall be apart from the Bidders all Risk Insurance Policy stipulated under General Conditions unless the Bidder incorporates blasting hazards and its coverage in the said general policy.
- e) Storing of blasting materials shall be strictly as per Explosive Regulations.

The bidder must acquaint himself with the site conditions in regard to blasting, nature of rock likely to be met with, timing and other restrictions to blasting etc. No. claims whatsoever in this regards shall be entertained.

1.2.7 Disposal of Surplus excavated materials

All materials considered surplus shall be removed to destinations and disposed off as directed. The disposal of the material can be in any of the following ways as directed by the Engineer.

Filling in low lying areas

Filling in at places of filling such as under floors, in roads, etc.

Stacking of material in pre-designated stacking yard.

Removal of material outside the plot for disposal.

1.2.8 Measurements

Measurements for all excavation, filling, carting away and earthwork shall be in solid measure. The rates quoted by the bidders are thus for solid measure units. The following factors shall be applied to obtain quantities of solid measure.

- | | |
|--------------|--|
| - Excavation | : Volume shall be determined by levels taken before commencement of excavation and after completion upto the |
|--------------|--|



VOLUME - 1

TECHNICAL BID DOCUMENT

AHMEDABAD MUNICIPAL CORPORATION (AMC), SWM DEPARTMENT

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required level.

- Filling watered and consolidated in layers : Volume shall be determined by levels taken before and after compacted filling and by measuring the length and breadth as required.
- Stack measure as in rubble, etc. : Volume of stack less 40%

The mode of measurement for various types of excavations shall be as under:-

- a) In case of trenches, pits and areas, measurements shall be on the basis of the width of foundation and the depth to bottom of foundation (bottom of bed concrete if provided) formation.
- b) Excavation in rock shall be measured up to levels indicated or required. No undulations as physically appearing after excavation shall be taken into consideration while arriving at the quantities.
- c) Where such measurement is not possible as in the case of strata intermixed with soil, excavated rock shall be properly stacked as directed by the Engineer and the volume of rock calculated on the basis of stack measurements after making appropriate allowance for voids.
- d) Excavation beyond the widths or depths required will not be paid for, any additional concrete or bedding material required as a result of over-excavation at the Bidder's expense.

1.2.9 Rates

The rates shall be inclusive of all the operations described above including clearing and grubbing, dewatering, shoring and disposal at site as directed by the Engineer.

- 1.3. Earth Filling, Backfilling and Site Grading in the low lying areas or crevices existing in the site to prepare inner side slopes and matching of the same with the other excavated areas to prepare a smooth surface for placement of liners and prevent damage of liners.

1.3.1 General

All fill material shall be subject to the Engineer's approval. If any material is rejected by Engineer, the Contractor shall remove the same forthwith from the site. Surplus fill material shall be deposited/disposed of as directed by Engineer after the fill work is completed.

No earthfill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with to the approval of the Engineer.

The Contractor shall not commence the placement of any fill or back fill at any location without the approval of the Engineer.



1.3.2 Material

To the extent available, selected surplus soils from excavations shall be used as backfill. Backfill material shall be free from lumps, organic or other foreign material. All lumps of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murrum or earth to fill the voids and the mixture used for filling.

If fill material is required to be imported, the Contractor shall make arrangements to bring such material from outside borrow pits. The material and source shall be subject to the prior approval of the Engineer. The approved borrow pit areas shall be cleared of all bushes, roots of trees, plants, rubbish, etc. Top soil containing foreign material shall be removed. The materials so removed shall be disposed of as directed by Engineer. The Contractor shall provide the necessary access roads to borrow areas and maintain the same if such roads do not exist, at his cost.

1.3.3 Filling in pits and trenches around foundations of structures, walls, etc.

As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches, etc., shall be cleared of all debris, and filled with earth in layers not exceeding 15 cm, each layer being watered, rammed and properly consolidated, before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer. Earth shall be rammed with approved mechanical compaction machines. Usually no manual compaction shall be allowed unless the Engineer is satisfied that in some cases manual compaction by tampers cannot be avoided. The final backfill surface shall be trimmed and leveled to a proper profile to the approval of the Engineer.

1.3.4 Sand Filling in Plinth and Other Places

At places where backfilling is required to be carried out with local sand it shall be clean, medium grained and free from impurities. The filled-in-sand shall be kept flooded with water for 24 hours and drained to ensure maximum hydraulic compaction. Any temporary work required to contain sand under flooded condition shall be on Contractor's account. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not be started until the Engineer has inspected and approved the fill.

1.3.5 Filling in Trenches

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed. The backfilling material shall be properly consolidated by watering and ramming, taking due care that no damage is caused to the pipes.



Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the center line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the center line of the pipes shall be done with selected earth by hand compaction, or other approved means in layers not exceeding 15 cm.

In case of excavation of trenches in rock, the filling up to a level 30 cm above the top of the pipe shall be done with approved excavated soil. The filling up to the level of the center line of the pipe shall be done by hand compaction in layers not exceeding 8 cm whereas the filling above the center line of the pipe shall be done by hand compaction or approved means in layers not exceeding 15 cm. The filling from a level 30 cm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 15 cm mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

1.3.6 General Site Grading

Site grading shall be carried out as indicated in the drawings and as approved by the Engineer. Excavation shall be carried out as specified in the Specifications. Filling and compaction shall be carried out as specified and elsewhere unless otherwise indicated below.

The fill shall be placed in layers not exceeding 200 mm and leveled uniformly and compacted before the next layer is deposited.

To ensure that the fill has been compacted as specified, field and laboratory tests shall be carried out by the Contractor at his cost.

Field compaction tests shall be carried out in each layer of filling until the fill to the entire height has been completed. This shall hold good for embankments as well. The fill will be considered as incomplete if the desired compaction has not been obtained.

The Contractor shall protect the earth fill from being washed away by rain or damaged in any other way. Should any slip occur, the Contractor shall remove the affected material and make good the slip at his cost.

If so specified, the rock as obtained from excavation may be used for filling and leveling to the indicated grades without further breaking. In such an event, filling shall be done in layers not exceeding 50 cm approximately. After rock filling to the approximate level, indicated above has been carried out, the voids in the rock filling shall be filled with finer materials such as earth, broken stone, etc. and the area flooded so that the finer materials fill up the voids. Care shall be taken to ensure that the finer fill material does not get washed out. Over the layer so filled, a 100 mm thick mixed layer of broken material and



earth shall be laid and consolidation carried out by a 12 ton roller. No less than twelve passes of the roller shall be accepted before subsequent similar operations are taken up.

1.3.7 Fill Density

The compaction, where so called for, shall comply with minimum 95% of maximum dry density as per IS 2720 (Part 8) at moisture content differing not more than 4% from the optimum moisture content. The Contractor shall demonstrate adequately by field and laboratory tests that the specified density has been obtained.

1.3.8 Lead

Lead for deposition/disposal of excavated material, shall be as specified in the respective item of work. No extra compensation is admissible on the grounds that the lead including that for borrowed material had to be transported over marshy or 'katcha' land/route.

1.3.9 Measurements

Backfilling as per specification the sides of foundations of columns, footings, structures, walls, tanks, rafts, trenches etc. with excavated material will be paid for separately. It shall be clearly understood that the rate quoted for excavation shall include stacking of excavated material as directed, excavation/packing of selected stacked material, conveying it to the place specified etc. as specified. As a rule, material to be backfilled shall be stacked temporarily as directed by the Engineer. Actual quantity of consolidated sand filling shall be measured and paid in cubic meters.

1.3.10 Rates

The rates shall be inclusive of clearing and grubbing, spreading, watering and compaction as per specification above.

Item No. 2: Construction of Earthen Bund on the existing ground level 6 m high in the specified inner side slope of 1:2.0 (1V:2.0H) and Outer side slope of 1:2.0 (1V:2.0H) as shown in the section drawings. The inner side slope of the earthen bund shall be constructed in such a way so as to match with the excavated inner side slope from ground level to the bottom of the phase. The bund shall be constructed in areas excluding the Phase 1 bund which is already existing.

The item includes transporting up to 2 km lead, filling, leveling, grading, dressing, watering and compaction of the earth obtained from the excavation work to construct earthen bund 6 m high on the existing ground level at the periphery of the excavated phase and in such a way to maintain the prescribed side slope as shown. The item also includes filling available excavated earth (excluding rock) in trenches, plinth, sides of foundations etc. in layers not exceeding 20 cm. in depth consolidating each deposited layer by ramming and watering complete.

The item includes transporting, filling, leveling, grading, dressing, watering and compaction of the earth from the excavation point to make earthen bunds in the prescribed side slopes and making



correct level of the filled excavated soil to give a smooth surface by applying manual labor. In compaction, it is necessary to achieve a proctor density of 90% on side slopes and 95% on bottom at every 20 cm layer thickness. Compaction may be done using a suitable compactor on side slopes and bottom in such a way that the best workmanship is available at the site. The work shall be carried out in true line and level as specified and shall be done in accordance with the instructions given by the AMC &/or its authorized persons including Engineer – in – Charge. The item shall be executed as per the no. of quality assurance tests specified and methodology for soil selection and application shall be as per the quality assurance plan provided separately at the end of the specifications.

Item No. 3: Providing and Laying of Amended Clay liner on the bottom and inner side slopes, including horizontal berm in 900 mm thickness:

The item includes P/L of amended clay liner using the soil obtained from the excavation working the site and mixing with good quality sodium bentonite in appropriate proportion with soil to achieve the desired permeability of 1×10^{-7} cm/sec on the bottom and inner side slopes up to the top of the earthen bund surface of the phase in a single layer of 900 mm thickness and compacted thoroughly. 2% bentonite is taken for evaluation of the cost of clay liner depending on the permeability of the soil obtained at the bottom most portion of the phase. The % of bentonite shall be determined based on the laboratory test as specified in the tests to be carried out in the technical bid of the tender. The exact proportion of the bentonite as determined in the laboratory shall be used by mixing procured bentonite sample with the selected soil sample and compacted to achieve a proctor density of 95% on the bottom and 90% on the side slopes, along with determination of Permeability of the liner to $< 1 \times 10^{-7}$ cm/sec shall be laid on the areas where the clay liner has to be applied. The item includes filling available excavated earth (excluding rock) and mixing with sodium bentonite in trenches, plinth, horizontal berm, sides of foundations etc. in layers not exceeding 23 cm. in depth consolidation each deposited layer by ramming and watering. The item shall be executed as per the no. of quality assurance tests specified and methodology for liner preparation and application shall be as per the quality assurance plan provided separately at the end of the specifications.

Item No. 4: Providing and laying of Drainage layer –300 mm thick at the bottom of the phase:

The item includes providing and laying of drainage layer at the base of the phase so as to allow leachate to flow to the leachate collection well. It includes first providing 100 mm thick layer of coarse aggregates consisting of hard quality crushed stones of 10 - 20 mm in size at the base, followed by another 100 mm thick layer of 6 – 10 mm size on it and finally a 100 mm thick layer of coarse sand on the top. The item shall be executed as per the no. of quality assurance tests specified and methodology for material selection and layer application shall be as per the quality assurance plan provided separately at the end of the specifications.

Item No. 5: Providing And Laying of 6.0 M Wide (5.80 M clear wide) RCC Road on the top Periphery of the Phase – Total road area - 5809Sqm excluding Phase 1 top service road which is already existing:



The item includes excavation, providing and laying 230 mm thk. rubble soling layer in the excavated area, 100 mm thick PCC (1:4:8) and 150 mm thk. RCC M30 layer.

- a) The excavation item includes mass excavation executed with mechanised efforts/machineries for foundation up to 1.5 m depth from EGL including sorting out stacking of useful material & disposing off excavated stuff up to 2.0 Km lead For Dense or Hard Soil.
- b) Providing and laying 230mm thk. Rubble stone filling with 33% murrum & Stone Metal in specified thickness with watering, compaction etc. complete. The rubble soling item includes providing and laying of rubble soling layer of specified thickness with hand packed stones and interstices filled with stone metal, including compacting it properly, leveling etc. complete as per drawing, specifications and as directed by Engineer-In-Charge.

The rubble soling item includes providing and laying of rubbles laid on the prepared base using 60 – 170 mm size rubbles which shall be hard, sound, durable, tough and of Himmatnagar/Dhrangdhra/Sevalia and/or equivalent approved make. The stone shall be quarried and shall be sound, angular, durable and free from flaws and decay and shall be approved by the Engineer in charge. The stone shall be stacked on neat and uniform ground at road sides, stack shall be of height not less than 1.0 m. The rubble spouls shall be screened for any rubbish dust or grass. Rubbles or spouls then shall be laid on herringbone bond to required grade and camber as directed by Engineer in charge. The rubble shall be sorted out from stacks. Extra earth debris, shall be removed and the rubbles/spouls shall be placed in position over the earth level formed to give a suitable soling formation by packing voids no hollow space is left. The soling shall be filled by selected earth to fill, interlock the small cavities between the soling and the whole soiling shall be made a compact, solid and continues level, which shall not be disturbed, while rolling. The entire surface shall be well watered and rolled with a heavy roller weight not less than 8 ton capacity. The gaps if any are formed shall be packed again by the same process. Spouls shall be laid on herringbone bond to required grade and camber.

- c) Providing & laying plain cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 hand broken stone aggregates 40 mm nominal size) and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.
- d) Providing and laying in position Ready Mixed M-300 grade concrete for reinforced cement concrete work over PCC as mentioned above, using cement content as per approved Design Mix manufactured in fully automatic batching plant and transported to site of work in transit mixer for a lead up to 10 km having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of



R.M.C. from transit mixer to site of laying, excluding the cost of centring/shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. Without Fly Ash (Min cement level as per latest IS 456 shall be maintained) (Cement level 475 kg).

- e) Supplying, cutting, bending, binding and hooking and binding with wire for RCC work for steel TMT Fe 500 D round bar including bending, binding and placing in position complete all costs up to floor two level as shown in the drawing.
- f) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure as shown in the drawing and including centring, shuttering and propping etc. Height of propping and centring below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Flat surfaces such as soffits of slabs Landings and the like for Floors etc. up to 200mm in thickness.
- g) Providing and fixing 25 mm thk. HD100 Polymer Expansion joint filler board in the expansion joint of the Mass Concrete at every 40 m length of road: 25 mm thk. HD100 Polymer based expansion joint filler board is a cross linked, pre moulded high performance joint filler board. It is readily compressible and ensures low load transfer. It is a closed cell with excellent chemical resistance, thermally stable up to 70°C, and very compressible as well as elastic with almost more than 90% recoverable to its original state and rot proof and bacteria resistant. The item includes procuring the product, preparation of application system and fixing the product all inclusive.

Item No. 6: Construction of Kerb Walls on both sides of the top service road in RCC M20. - 1) On top edge of outer side of top service road - 600 mm high and 100 mm thk. - 988 m long, (Excluding Phase 1 side) 2) On top edge of Inner side of top service road - 600 mm high and 100 mm thk. - 1278 m long (Including Phase 1 side).

- a) The item includes making of Kerb Wall on both side edges of the phase top service road. The work includes providing and laying of RCC M 20 excluding form work for RCC, curing and steel reinforcement. It includes Providing and laying in position Ready Mixed M-200 grade concrete for reinforced cement concrete work , using cement content as per approved Design Mix manufactured in fully automatic batching plant and transported to site of work in transit mixer for a lead up to 10 km having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying, excluding the cost of centring shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. Without Fly Ash (Min cement level as per latest IS 456 shall be maintained).



- b) Supplying, cutting, bending, binding and hooking and binding with wire for RCC work for steel TMT Fe 500 D round bar including bending, binding and placing in position complete all costs up to floor two level as shown in the drawing.
- c) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure as shown in the drawing and including centring, shuttering and propping etc. Height of propping and centring below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Flat surfaces such as soffits of slabs Landings and the like for Floors etc. up to 200mm in thickness.

Item No. 7: Construction of Outer Side Slope on the Earthen Bund in specified slope. Following works are to be carried out on the outer side slope of total slope length –13.42 m The item includes protection of Outer side slope by P/L of 230 mm thk. Rubble Soling, 100 mm thk. PCC (1:4:8) and 100 mm thk. RCC M20 on the outer side slope. Total Area of outer side slope is 14064Sq.m.

Following works are to be carried out on the outer side slope of total slope length 13.42 m.

The item includes protection of Outer side slope by excavating, P/L of 230 mm thick Rubble Soling, 100 mm thick PCC (1:4:8) and 100 mm thick RCC M20 on the outer side slope. Total Area of outer side slope is 14064Sq.m.

- a) The excavation item includes mass excavation executed with mechanised efforts/machineries for foundation up to 1.5 m depth from EGL including sorting out stacking of useful material & disposing off excavated stuff up to 2.0 Km lead For Dense or Hard Soil.
- b) Providing and laying 230mm thk. Rubble stone filling with 33% murrum & Stone Metal in specified thickness with watering, compaction etc. complete. The rubble soling item includes providing and laying of rubble soling layer of specified thickness with hand packed stones and interstices filled with stone metal, including compacting it properly, leveling etc. complete as per drawing, specifications and as directed by Engineer-In-Charge.

The rubble soling item includes providing and laying of rubbles laid on the prepared base using 60 – 170 mm size rubbles which shall be hard, sound, durable, tough and of Himmatnagar/Dhrangdhra/Sevalia and/or equivalent approved make. The stone shall be quarried and shall be sound, angular, durable and free from flaws and decay and shall be approved by the Engineer in charge. The stone shall be stacked on neat and uniform ground at road sides, stack shall be of height not less than 1.0 mt. The rubble spouls shall be screened for any rubbish dust or grass. Rubbles or spouls then shall be laid on herringbone bond to required grade and camber as directed by Engineer in charge. The rubble shall be sorted out from stacks. Extra earth debris, shall be removed and the rubbles/spouls shall be placed in position over the earth level formed to give a suitable soling formation by packing voids no hollow space is left. The soling shall be filled by selected earth to fill, interlock the



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small cavities between the soling and the whole soiling shall be made a compact, solid and continues level, which shall not be disturbed, while rolling. The entire surface shall be well watered and rolled with a heavy roller weight not less than 8 ton capacity. The gaps if any are formed shall be packed again by the same process. Spouls shall be laid on herringbone bond to required grade and camber.

- c) Providing & laying plain cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 hand broken stone aggregates 40 mm nominal size) and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.
- d) Providing and laying in position Ready Mixed M-200 grade concrete for reinforced cement concrete work over PCC as mentioned above, using cement content as per approved Design Mix manufactured in fully automatic batching plant and transported to site of work in transit mixer for a lead up to 10 kms having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying, excluding the cost of centering/shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. Without Fly Ash (Min cement level as per latest IS 456 shall be maintained).
- e) Supplying, cutting, bending, binding and hooking and binding with wire for RCC work tor steel TMT Fe 500 D round bar including bending, binding and placing in position complete all costs up to floor two level as shown in the drawing.
- f) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure as shown in the drawing and including centering, shuttering and propping etc. Height of propping and centering below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Flat surfaces such as soffits of slabs Landings and the like for Floors etc. up to 200mm in thickness.
- g) Providing and fixing 25 mm thk. HD100 Polymer Expansion joint filler board in the expansion joint of the Mass Concrete at every 48 m length of road: 25 mm thk. HD100 Polymer based expansion joint filler board is a cross linked, pre moulded high performance joint filler board. It is readily compressible and ensures low load transfer. It is a closed cell with excellent chemical resistance, thermally stable up to 70°C, and very compressible as well as elastic with almost more than 90% recoverable to its original state and rot proof and bacteria resistant. The item includes procuring the product, preparation of application system and fixing the product all inclusive.



Item No. 8: Construction of Storm Water Drain around landfill phase periphery on GL - 1 m wide - 1108 m in length, 0.80 m depth:

The item includes construction of Storm Water Drain in RCC M20 on the G/L at the bottom edge of the outer side slope. The item includes excavation, providing and laying 230 mm thick rubble soling layer in the excavated area, 100 mm thick PCC (1:4:8) and specified thickness RCC M20 layer.

- a) The excavation item includes mass excavation executed with mechanised efforts/machineries for foundation up to 1.5 m depth from EGL including sorting out stacking of useful material & disposing off excavated stuff up to 2.0 Km lead For Dense or Hard Soil.
- b) Providing and laying 230mm thk. Rubble stone filling with 33% murrum& Stone Metal in specified thickness with watering, compaction etc. complete. The rubble soling item includes providing and laying of rubble soling layer of specified thickness with hand packed stones and interstices filled with stone metal, including compacting it properly, leveling etc. complete as per drawing, specifications and as directed by Engineer-In-Charge.

The rubble soling item includes providing and laying of rubbles laid on the prepared base using 60 – 170 mm size rubbles which shall be hard, sound, durable, tough and of Himmatnagar/Dhrangdhra/Sevalia and/or equivalent approved make. The stone shall be quarried and shall be sound, angular, durable and free from flaws and decay and shall be approved by the Engineer in charge. The stone shall be stacked on neat and uniform ground at road sides, stack shall be of height not less than 1.0 mt. The rubble spouls shall be screened for any rubbish dust or grass. Rubbles or spouls then shall be laid on herringbone bond to required grade and camber as directed by Engineer in charge. The rubble shall be sorted out from stacks. Extra earth debris, shall be removed and the rubbles/spouls shall be placed in position over the earth level formed to give a suitable soling formation by packing voids no hollow space is left. The soling shall be filled by selected earth to fill, interlock the small cavities between the soling and the whole soiling shall be made a compact, solid and continues level, which shall not be disturbed, while rolling. The entire surface shall be well watered and rolled with a heavy roller weight not less than 8 ton capacity. The gaps if any are formed shall be packed again by the same process. Spouls shall be laid on herringbone bond to required grade and camber.

- c) Providing & laying plain cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 hand broken stone aggregates 40 mm nominal size) and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.



- d) Providing and laying in position Ready Mixed M-200 grade concrete for reinforced cement concrete work over PCC as mentioned above, using cement content as per approved Design Mix manufactured in fully automatic batching plant and transported to site of work in transit mixer for a lead up to 10 kms having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying, excluding the cost of centering/shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. Without Fly Ash (Min cement level as per latest IS 456 shall be maintained).
- e) Supplying, cutting, bending, binding and hooking and binding with wire for RCC work for steel TMT Fe 500 D round bar including bending, binding and placing in position complete all costs up to floor two level as shown in the drawing.
- f) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure as shown in the drawing and including centering, shuttering and propping etc. Height of propping and centering below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Flat surfaces such as soffits of slabs Landings and the like for Floors etc. up to 200mm in thickness.
- g) Providing and Laying of RCC Precast Top Cover for covering of SWD using 90 cm x 90 cm size cover with perforations on the top of the cover to allow rain water easily into the drain.

Item No. 9: Construction of Toe Wall in Brick Masonry on outer side slope bottom edge with its one edge forming the wall of Storm Water Drain - 1108 m in length

The item includes making of toe wall at the bottom of the outside slope of the earthen bund. The work includes excavation for foundation of the toe wall, providing and laying of 230 mm thk. Rubble soling, providing and laying of 100 mm PCC (1:4:8), 230 mm thick Brick masonry in CM (1:6) and 20 mm thick single coat water proof finish plaster.

- a) The excavation item includes mass excavation executed with mechanised efforts/machineries for foundation up to 1.5 m depth from EGL including sorting out stacking of useful material & disposing off excavated stuff up to 2.0 Km lead For Dense or Hard Soil.
- b) Providing and laying 230mm thk. Rubble stone filling with 33% murrum & Stone Metal in specified thickness with watering, compaction etc. complete. The rubble soling item includes providing and laying of rubble soling layer of specified thickness with hand packed stones and interstices filled with stone metal, including compacting it properly, leveling etc. complete as per drawing, specifications and as directed by Engineer-In-Charge.



The rubble soling item includes providing and laying of rubbles laid on the prepared base using 60 – 170 mm size rubbles which shall be hard, sound, durable, tough and of Himmatnagar/Dhrangdhra/Sevalia and/or equivalent approved make. The stone shall be quarried and shall be sound, angular, durable and free from flaws and decay and shall be approved by the Engineer in charge. The stone shall be stacked on neat and uniform ground at road sides, stack shall be of height not less than 1.0 mt. The rubble spools shall be screened for any rubbish dust or grass. Rubbles or spools then shall be laid on herringbone bond to required grade and camber as directed by Engineer in charge. The rubble shall be sorted out from stacks. Extra earth debris, shall be removed and the rubbles/spools shall be placed in position over the earth level formed to give a suitable soling formation by packing voids no hollow space is left. The soling shall be filled by selected earth to fill, interlock the small cavities between the soling and the whole soiling shall be made a compact, solid and continues level, which shall not be disturbed, while rolling. The entire surface shall be well watered and rolled with a heavy roller weight not less than 8 ton capacity. The gaps if any are formed shall be packed again by the same process. Spools shall be laid on herringbone bond to required grade and camber.

- c) Providing & laying plain cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 hand broken stone aggregates 40 mm nominal size) and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.
- d) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure as shown in the drawing and including centering, shuttering and propping etc. Height of propping and centering below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Flat surfaces such as soffits of slabs Landings and the like for Floors etc. up to 200mm in thickness.
- e) The Brick Masonry item includes providing and laying of brick masonry on the PCC laid above for the construction of storm water drains as indicated. The cement mortar applied shall be in the ratio of 1:6. Good quality Conventional common burnt clay bricks having crushing strength not less than 35 kg/sq.cm shall be used & the bricks drenched in water shall be used for construction. Proper watering & curing shall be applied for setting of cement & required strength.
- f) Providing and applying 20 mm thick cement plaster in single coat on single or half brick wall for interior plastering up to floor two level finished even and smooth in cement mortar 1:4 (1 cement : 4 fine sand) incl. racking of joints of masonry and roughening of concrete surface (i.e. hacking) to receive plaster, as well as providing and mixing water proofing of 50 kg of material in cement mortar and finishing smooth with a floating coat of neat cement slurry mixing, applying, watering, curing with all labour and materials.

**Item No. 10: Construction of Leachate Wells in RCC M25 - 3 Nos., 3 m diameter x 23.715 m (H):**

The leachate wells – 3 Nos. have to be constructed in RCC M25 grade concrete of Diameter 3.0 m x 23.715 m (H) with 200 mm thickness wall as shown in the drawing. The item includes excavation of soil, P/L of 300 mm thick Rubble Soling, 200 mm thick PCC (1:4:8) and specified thickness of RCC M25 grade, P/L of reinforcement bars for RCC, Form work for PCC and RCC works, 20 mm thk. Single coat finish cement plaster in CM (1:4) and back filling of the excavated soil. For construction of leachate tanks a pit of size 100 m (L) x 65 m (W) and 22.715 m (D) in a slope of 1:1 needs to be constructed in order to provide space for construction of the three nos. of tanks as per the construction drawing. After construction, the remaining space shall be backfilled with the excavated soil and duly compacted, rolled and watered. The Leachate Wells shall be constructed outside the Phase on the GL in the Green Belt Area as shown in the Layout Plan with 20 m C- C distance between each well and all the wells shall be connected with the Leachate Main Header Pipe – 315 mm OD laid at the bottom of the phase in the bottom liner system of the phase. The Main header pipes shall be brought outside from the bottom of the earthen bund by drilling horizontal bore 600 mm diameter in the bund and inserting a NP3 RCC pipe of 500 mm diameter to prevent falling of the soil in the horizontal bore.

- a) The excavation item includes mass excavation executed with mechanised efforts/machineries for foundation up to 1.5 m depth from EGL including sorting out stacking of useful material & disposing off excavated stuff up to 2.0 Km lead For Dense or Hard Soil.
- b) Providing and laying 230mm thk. Rubble stone filling with 33% murrum & Stone Metal in specified thickness with watering, compaction etc. complete. The rubble soling item includes providing and laying of rubble soling layer of specified thickness with hand packed stones and interstices filled with stone metal, including compacting it properly, leveling etc. complete as per drawing, specifications and as directed by Engineer-In-Charge.

The rubble soling item includes providing and laying of rubbles laid on the prepared base using 60 – 170 mm size rubbles which shall be hard, sound, durable, tough and of Himmatnagar/Dhrangdhra/Sevalia and/or equivalent approved make. The stone shall be quarried and shall be sound, angular, durable and free from flaws and decay and shall be approved by the Engineer in charge. The stone shall be stacked on neat and uniform ground at road sides, stack shall be of height not less than 1.0 mt. The rubble spouls shall be screened for any rubbish dust or grass. Rubbles or spouls then shall be laid on herringbone bond to required grade and camber as directed by Engineer in charge. The rubble shall be sorted out from stacks. Extra earth debris, shall be removed and the rubbles/spouls shall be placed in position over the earth level formed to give a suitable soling formation by packing voids no hollow space is left. The soling shall be filled by selected earth to fill, interlock the small cavities between the soling and the whole soiling shall be made a compact, solid and continues level, which shall not be disturbed, while rolling. The entire surface shall be well watered and rolled with a heavy roller weight not less than 8 ton capacity. The gaps if any



are formed shall be packed again by the same process. Spouls shall be laid on herringbone bond to required grade and camber.

- c) Providing & laying plain cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 hand broken stone aggregates 40 mm nominal size) and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.
- d) Providing and laying in position Ready Mixed M-250 grade concrete for reinforced cement concrete work over PCC as mentioned above, using cement content as per approved Design Mix manufactured in fully automatic batching plant and transported to site of work in transit mixer for a lead up to 10 kms having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying, excluding the cost of centering/shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. Without Fly Ash (Min cement level as per latest IS 456 shall be maintained). (Cement level 450 kg)
- e) Supplying, cutting, bending, binding and hooking and binding with wire for RCC work tor steel TMT Fe 500 D round bar including bending, binding and placing in position complete all costs up to floor two level as shown in the drawing.
- f) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure as shown in the drawing and including centering, shuttering and propping etc. Height of propping and centering below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Flat surfaces such as soffits of slabs Landings and the like for Floors etc. up to 200mm in thickness.
- g) Providing and applying 20 mm thick cement plaster in single coat on single or half brick wall for interior plastering up to floor two level finished even and smooth in cement mortar 1:4 (1 cement : 4 fine sand) incl. racking of joints of masonry and roughening of concrete surface (i.e. hacking) to receive plaster, as well as providing and mixing water proofing of 50 kg of material in cement mortar and finishing smooth with a floating coat of neat cement slurry mixing, applying, watering, curing with all labour and materials.

Item No. 11: Providing and Laying of Leachate Collection system comprising of Leachate pipe network - 160 mm dia lateral pipes of length – 1456 m long, 315 mm dia main header pipes - 387 m, 400 mm dia main header pipes - 60 m and 160 mm dia whole pipes - 200 m for transferring leachate from leachate tanks upto the leachate disposal system laid in Leachate Collection trench placed at the bottom of the phase and on the GL as indicated in the drawing



The item includes providing and laying of 160 mm outer diameter size HDPE pipes of 10 Kg/cm² pressure grade and ISI make as per IS – 14333:1996 with material grade PE – 100 and material density of > 950 Kg/cm² or its latest revision/amendments including all local and central taxes & duties, freight charges, loading, unloading and conveyance to departmental stores etc. complete, in standard length suitable for sewage and Industrial effluents and having holes of 10 mm @ centre to centre 140 mm distance in the upper half section of the pipes and having an arc length of 70 mm, throughout the length of the pipes as shown in the diagram attached. The pipes are to be laid horizontally in the drainage layer at the bottom of the phase as shown in the layout plan of the landfill and are connected with the main header HDPE pipe of 400 mm OD. Leachate Tanks are connected with the help of 315 mm OD main header pipes which in turn are connected with the 400 mm OD pipes. The pipes connecting the main header pipe are to be laid in such a way so as to make a slope of min. 2.0 % available to allow leachate to flow easily in to the Leachate well. The pipes are to be laid in a leachate collection trench. The Leachate wells situated outside the phase are to be connected with 315 mm outer diameter main header. The leachate wells shall have a leachate lifting system with sludge pumps provided at the bottom of the wells and delivery pipe brought to the G/L and provided with valves for discharging leachate to the leachate. Moreover the 315 mm size pipes shall be brought out of the phase bottom and connected to the leachate tanks by drilling horizontal bore of 600 mm size and fixing of 500 mm dia RCC casing pipe.

- a) The item includes providing and laying of 160 mm OD size HDPE perforated pipes as lateral pipes of 10 Kg/cm² pressure grade and ISI make as per IS – 14333:1996 with material grade PE – 100 and material density >950 Kg/cm². The lateral pipes shall have holes of 10 mm @ center to center 140 mm distance and pitch of 70 mm arc length between two holes in the upper half section of the pipes, throughout the length of the pipes including the necessary pipe fittings as required for making connections of the pipes and as shown in the diagram attached. The 160 mm OD lateral pipes are to be laid horizontally at the bottom of the phase as shown in the layout plan of the landfill and are connected with the 400 mm OD main header pipe which is in turn connected with 315 mm OD main header pipes that are ultimately connected with the RCC leachate wells outside the phase. The lateral pipes connecting the 400 mm OD pipe are to be laid in such a way so as to make a slope of 1.13% in the lateral side (length side) and 2% on the (width side) with the center line at the lowest level and end of pipes at the highest level to allow leachate to flow easily in to the main header pipe. The pipes shall be laid in a leachate collection trench constructed in the top layer of the clay liner so that the pipes shall be laid in the drainage layer for effective leachate management. The detail of the pipe network is shown in the Lay out diagram of the Leachate collection system.
- b) The 315 mm main header pipes are to be laid horizontally at the bottom of the phase as shown in the layout plan of the landfill and are connected with the RCC leachate wells outside the phase. The pipes connecting the leachate well are to be laid in such a way so as to make a slope of 1.13% in the lateral side to allow leachate to flow easily in to the Leachate well. This is done in order to prevent stagnation of leachate in the pipes. The base slope of the phase has to be made in such a way that above slope is available on both sides of the pipes laid so as to allow the leachate to flow easily into the pipes. The pipes shall be laid in a leachate collection trench constructed in the top layer of the clay liner so that the



pipes shall be laid in the drainage layer for effective leachate management. The detail of the pipe network is shown in the Lay out diagram of the Leachate collection system.

- c) The 400 mm OD main header pipe is to be laid horizontally (width wise) at the bottom of the phase as shown in the layout plan of the landfill and is connected with the 160 mm OD lateral pipes on one side and 315 mm OD main header pipe on the other side. The pipe shall be laid in a leachate collection trench constructed in the top layer of the clay liner. The detail of the pipe network is shown in the Lay out diagram of the Leachate collection system.
- d) Providing and Laying of 160 mm diameter HDPE whole pipe of 10 Kg/CM² grade and ISI make for leachate withdrawal from tank with complete pipe fittings and other auxiliaries as needed. It shall also include interconnecting these pipes to the leachate storage tanks provided at the GL for storage and further disposal of leachate into the main SWD situated on the other side of the main road.
- e) Providing and Laying of Leachate Collection Trench (1) in the Amended Clay liner top to fix pipes at specified locations – 1456 m for 160 mm Perforated HDPE pipes, 160 m for whole HDPE pipes for leachate transfer pipe to main SWD on the other side of the main road and Leachate Collection Trench (2) in the Amended Clay Liner top to fix 387 m for 315 mm main header pipe and 60 m for 400 mm main header pipe:
 - a. The excavation item includes mass excavation executed with mechanised efforts/machineries for foundation up to 1.5 m depth from EGL including sorting out stacking of useful material & disposing off excavated stuff up to 2.0 Km lead For Dense or Hard Soil.
 - b. Providing & laying plain cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 hand broken stone aggregates 40 mm nominal size) and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.
- f) The leachate wells shall have a leachate lifting system with submersible sludge pumps provided inside the leachate well. The item includes Providing and Laying of Sludge pumps – 3 Nos. with complete electrical system including high efficiency motor, control panels etc. complete with the following specifications:
 - i. Pump Type: Vertical Centrifugal Submersible Sewage Pump.
 - ii. Specifications: No. of Stages - 1, Delivery size: 150mm (6"), Discharge. Rate: 4000 LITER / MIN (240M³/HOUR), 25 m head, Shut off head - 40 m, Type of Impeller - Semi Open Type, Seal: TC/TC Mechanical Seal; Material of Construction: Pump Body, Impeller, Suction Case and Discharge Case of Cast Iron & Shaft of EN8; Prime Mover: 50HP x 1440 RPM 3-Phase 415 VAC 50 Hz, Submersible Induction Motor connected with a cable of 10.0 Core x 4.0 Sq. mm size with minimum 50 m Length.



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- iii. The pumps should be capable of handling 25 mm size of particles in the leachate and of non clog type. It should also have a control panel - Dol starter with overload, SPP, water level guard for auto run pump, thermal & moisture protection, over voltage, dry run ampere base protection with indoor type control panel.
- g) Drilling of 600 mm diameter horizontal borehole for watermain pipeline crossing under the road including all strata with required length including fixing of 500 mm diameter MS/RCC casing pipe with pushing etc. complete various sizes of pipes for 273.10 to 355.60 mm diameter watermain (For 45 m length).
- h) Providing and Laying of RCC Casing Pipe 500 mm OD for insertion in Horizontal borehole - Providing, laying and jointing works complete to be inserted in Horizontal Borehole for 315 mm OD HDPE pipes. The item includes providing and supplying of ISI standard 500 mm diameter RCC pipes (of Sulphate resisting Cement) in standard lengths of following class and diameter suitable for either collar joints or rubber ring joints including all taxes, insurance, transportation, freight charges, octroi, inspection charges, loading, unloading, conveyance to departmental stores, stacking etc. complete and insertion of 315 mm Main header HDPE leachate pipe in the RCC casing pipe, which shall be connected with the 3 Nos. of Leachate Wells provided outside of the phase.
- i) Construction of Underground Water Sump at GL for Collecting Storm Water/Leachate obtained from Leachate Wells for further disposal into the SWD. - 2 Nos. Size - 10m x 5 m x 3m (D):
 - a. The excavation item includes mass excavation executed with mechanised efforts/machineries for foundation up to 3.0 m depth from EGL including sorting out stacking of useful material & disposing off excavated stuff up to 2.0 Km lead For Soft Soil/Dense or Hard Soil.
 - b. The item includes Filling available excavated earth (excluding rock) in trenches. plinth, sides of foundations etc. in layers not exceeding 20 cm. in depth consolidating each deposited layer by ramming and watering etc. complete on the excavated portions left out after construction of the leachate tanks.
 - c. Providing and filling rubbles including hand packing and filling interstices with quarry spalls behind abutments and behind returns as directed.
 - d. Providing and laying plain cement concrete (1:3:6) at the excavated areas and it includes machine mixing, watering, laying, spreading, levelling, consolidating, curing etc. complete with all labour and materials without form work and reinforcement.
 - e. Providing and laying in position Ready Mixed M-250 grade concrete for reinforced cement concrete work , using cement content as per approved Design Mix manufactured in fully automatic batching plant and transported to site of work in transit mixer for a lead up to 10 km having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying, excluding the cost of centring, shuttering, finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. Without Fly Ash (Min cement level as per latest IS 456 shall be maintained) (Cement level 450 kg)in:
 - i. (A) In Foundations, footings, base of columns and mass concrete.



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- ii. (B) In Walls from top of foundation level upto floor two level.
- iii. (C) In Slabs, landing, shelves, Balconies, Lintels, Beams, Girders and Cantilever up to floor two level.
- f. Supplying, cutting, bending, binding and hooking and binding with wire for RCC work for steel TMT Fe 500 D round bar including bending, binding and placing in position complete all costs up to floor two level as shown in the drawing.
- g. Providing and applying 20 mm thick cement plaster in single coat on single or half brick wall for interior plastering up to floor two level finished even and smooth in cement mortar 1:4 (1 cement : 4 fine sand) incl. racking of joints of masonry and roughening of concrete surface (i.e. hacking) to receive plaster, as well as providing and mixing water proofing of 50 kg of material in cement mortar and finishing smooth with a floating coat of neat cement slurry mixing, applying, watering, curing with all labour and materials.
- h. Providing and fixing in position cast iron manhole cover with CI frame size 600 x 450 mm and weight about 35 kg of approved quality as per drawing and as directed by Engineer-In-Charge.
- i. Providing and fixing in position cowl vent to pipe of 75mm dia.
- j. Finishing wall with water proofing cement paint on an undecorated wall surfaces (two coats) to give an approved brand and manufacture (Snowcem, Deorocem or other similar brands approved) and of required shape even shade after thoroughly brushing the surface to remove all dirt and remains of loose powdered materials.
- k. Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure as shown in the drawing and including centring, shuttering and propping etc. Height of propping and centring below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in: Flat surfaces such as soffits of slabs Landings and the like. (1) Floors etc. up to 200mm in thickness.
- l. Providing cement vata (10 cm x 10 cm) size quarter round in cement mortar 1:1 including near cement finishing, watering etc. complete.
- m. Providing and Laying of Sludge pumps with complete electrical system including high efficiency motor, control panels etc. complete with the following specifications:
Pump Type: Vertical Centrifugal Submersible Sewage Pump with Specifications as follow:
 - i. No. of Stages – 1
 - ii. Delivery size: 150mm(6")
 - iii. Discharge Rate: 4000 LITER / MIN (240Cu.m./Hr)
 - iv. Discharge Head: 25 m
 - v. Shut off head: 40 m
 - vi. Type of Impeller - Semi Open Type
 - vii. Seal: TC/TC Mechanical Seal
 - viii. Material of Construction: Pump Body, Impeller, Suction Case and Discharge Case of Cast Iron & Shaft of EN8
 - ix. Prime Mover: 50HP x 1440 RPM, 3-Phase, 415VAC, 50 Hz, Submersible Induction Motor

**Item No. 12: Construction of 2 Nos. of Approach Ramps - One for Entry into the landfill and One for Exit from the landfill, 7 m wide 140 m slope length. Slope for Entry Ramp - 1:9.523 and Slope for Exit Ramp - 1:8.284 slope in RCC + Entrance Area Development + Kerb walls 0.60 m high on both the edges of the ramp:**

The item includes construction of approach ramps - 2 Nos. in RCC 7 m width (6.80 m Clear width), for truck movement into and out of the phase. The ramps shall be constructed with bottom liners at the base followed by 230 mm thick rubble soling, 100 mm thick PCC (1:4:8), 150 mm thick RCC M30 and provision of kerb walls 600 mm high and 100 mm thick in RCC over the liners as shown in the drawing. Total area of Entry ramp with side slopes is 2435 Sq m and entrance area shall be 174 Sq m., Slope length is 140 m and it shall be open from the GL level. Similarly Total area of Exit ramp with side slopes is 2653 Sqm and Exit area shall be 556 Sqm, Slope length is 140 m and it shall be open from the GL level and constructed from the starting point shown in the drawing.

- a) Providing and laying 230mm thk. Rubble stone filling with 33% murrum & Stone Metal in specified thickness with watering, compaction etc. complete. The rubble soling item includes providing and laying of rubble soling layer of specified thickness with hand packed stones and interstices filled with stone metal, including compacting it properly, leveling etc. complete as per drawing, specifications and as directed by Engineer-In-Charge.

The rubble soling item includes providing and laying of rubbles laid on the prepared base using 60 – 170 mm size rubbles which shall be hard, sound, durable, tough and of Himmatnagar/Dhrangdhra/Sevalia and/or equivalent approved make. The stone shall be quarried and shall be sound, angular, durable and free from flaws and decay and shall be approved by the Engineer in charge. The stone shall be stacked on neat and uniform ground at road sides, stack shall be of height not less than 1.0 mt. The rubble spouls shall be screened for any rubbish dust or grass. Rubbles or spouls then shall be laid on herringbone bond to required grade and camber as directed by Engineer in charge. The rubble shall be sorted out from stacks. Extra earth debris, shall be removed and the rubbles/spouls shall be placed in position over the earth level formed to give a suitable soling formation by packing voids no hollow space is left. The soling shall be filled by selected earth to fill, interlock the small cavities between the soling and the whole soiling shall be made a compact, solid and continues level, which shall not be disturbed, while rolling. The entire surface shall be well watered and rolled with a heavy roller weight not less than 8 ton capacity. The gaps if any are formed shall be packed again by the same process. Spouls shall be laid on herringbone bond to required grade and camber.

- b) Providing & laying plain cement concrete 1:4:8 (1 cement: 4 coarse sand: 8 hand broken stone aggregates 40 mm nominal size) and curing complete in Foundation and plinth. The PCC item includes providing and laying of 100 mm PCC (1:4:8) on the areas excavated as above in the specified proportion so as to cover the surface completely and give a finished surface. Mixing of concrete shall be done with the help of mechanical mixer and the mixer drum shall be turned at least for 1½ minutes after all the ingredients are added and the drum shall be placed on the water tight platform. The cement concrete shall be kept well watered for efficient setting.



- c) Providing and laying in position Ready Mixed M-300 grade concrete for 150 mm thick reinforced cement concrete work over PCC as mentioned above, using cement content as per approved Design Mix manufactured in fully automatic batching plant and transported to site of work in transit mixer for a lead up to 10 km having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying, excluding the cost of centring/shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. Without Fly Ash (Min cement level as per latest IS 456 shall be maintained) (Cement level 475 kg).
- d) Supplying, cutting, bending, binding and hooking and binding with wire for RCC work tor steel TMT Fe 500 D round bar including bending, binding and placing in position complete all costs up to floor two level as shown in the drawing.
- e) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure as shown in the drawing and including centring, shuttering and propping etc. Height of propping and centring below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in Flat surfaces such as soffits of slabs Landings and the like for Floors etc. up to 200mm in thickness.
- f) Providing and fixing 25 mm thk. HD100 Polymer Expansion joint filler board in the expansion joint of the Mass Concrete at every 40 m length of road: 25 mm thk. HD100 Polymer based expansion joint filler board is a cross linked, pre moulded high performance joint filler board. It is readily compressible and ensures low load transfer. It is a closed cell with excellent chemical resistance, thermally stable up to 70°C, and very compressible as well as elastic with almost more than 90% recoverable to its original state and rot proof and bacteria resistant. The item includes procuring the product, preparation of application system and fixing the product all inclusive.

Item No. 13: Site Clearing and Leveling Works:**A) Clearing and Grubbing**

The site has to be cleared off all the Ganda Bawal Trees, bushes, vegetation, solid waste etc., i.e. anything lying on the top surface of the site by mechanical means. After the trees are cut, the stumps have to be removed and carted to the place shown by Engineer in Charge.

The item includes Clearing and grubbing road/ land including uprooting rank vegetation grass, bushes, shrubs, sapling and trees girth upto 300mm removal of stumps of trees cut earlier and disposal of unserviceable materials to a site as directed by Engineer in Charge. This work shall be done by mechanical means in the areas of thorny jungle.

**B) Strip top soil**

Earthwork for the leveling should be done by a road roller by maintaining the soil at optimum moisture content. A bench mark has to be fixed at an immovable known point. Site shall be leveled before marking for excavation. The ground level is considered as RL42.50. In general all work shall be carried out as per instruction of Engineer in Charge. It includes Levelling of ground including necessary cutting or filling and rolling with roller as per instruction etc. complete. Rolling and consolidation using vibratory road roller 8 -10 tonne capacity (including watering) up to a layer of 200 mm thickness and making site ready for excavation work.

Item No. 14: Demolition and Dismantling Works:

The item includes Demolition and Dismantling of RCC surface, constructed buildings like ground level houses in Brick masonry, earth work, etc. including stacking of serviceable materials and disposal of unserviceable materials with all lead and lift as directed by the Engineer In Charge. This work is mainly related to the AMTS Depot area constructed at the site and the part of it shall be covered in the site and also includes demolition of any constructed buildings/houses.

Item No. 15: Extra Soil brought from out side for filling into Site at designated places:

The item includes Earthwork for embankment including breaking clods, dressing with all lead and lift and including watering, rolling and consolidation of subgrade in layers at O.M.C to required dry density including filling the depression which occur during the process using power roller 8T to 10T from borrow pit area within 5.0 km lead. It also includes carriage of the earth from borrow pits upto 5 km lead, filling, compaction, watering, rolling etc. complete into the different areas of the site at designated places.

Item No. 16: Backfilling and Levelling of Soil obtained from Excavation in low lying areas of phase to construct inner side slopes and horizontal berm in deep crevices:

The item includes backfilling of soil obtained from excavation in the low lying areas of the phase in order to construct inner side slopes and horizontal berm including backfilling, compaction, rolling, watering to achieve a proctor density of 90% on the side slopes and 95% on the bottom of the phase. The backfilling shall be done in such a way so as to match with the normal side slopes excavated in the sides.

It includes Filling available excavated earth (excluding rock) in trenches. plinth, sides of foundations etc. in layers not exceeding 20 cm. in depth consolidating each deposited layer by ramming and watering etc. complete. The work shall be carried out exactly in accordance with the instruction of the corporation &/or its authorized persons including Engineer - in – charge. The soil needed for backfilling shall be obtained from the nearby dumped excavated earth with in the site as suggested by the Engineer In Charge. The cost includes the filling, transportation and dumping at the required area from the nearby dumped excavated earth area as well as compaction, rolling, watering to desired proctor density as indicated above.



16.1 General

All fill material shall be subject to the Engineer's approval. If any material is rejected by Engineer, the Contractor shall remove the same forthwith from the site. Surplus fill material shall be deposited/disposed of as directed by Engineer after the fill work is completed.

No earthfill shall commence until surface water discharges and streams have been properly intercepted or otherwise dealt with to the approval of the Engineer.

The Contractor shall not commence the placement of any fill or back fill at any location without the approval of the Engineer.

16.2 Material

To the extent available, selected surplus soils from excavations shall be used as backfill. Backfill material shall be free from lumps, organic or other foreign material. All lumps of earth shall be broken or removed. Where excavated material is mostly rock, the boulders shall be broken into pieces not larger than 150 mm size, mixed with properly graded fine material consisting of murrum or earth to fill the voids and the mixture used for filling.

If fill material is required to be imported, the Contractor shall make arrangements to bring such material from outside borrow pits. The material and source shall be subject to the prior approval of the Engineer. The approved borrow pit areas shall be cleared of all bushes, roots of trees, plants, rubbish, etc. Top soil containing foreign material shall be removed. The materials so removed shall be disposed of as directed by Engineer. The Contractor shall provide the necessary access roads to borrow areas and maintain the same if such roads do not exist, at his cost.

16.2.1 Filling in pits and trenches around foundations of structures, walls, etc.

As soon as the work in foundations has been accepted and measured, the spaces around the foundations, structures, pits, trenches, etc., shall be cleared of all debris, and filled with earth in layers not exceeding 15 cm, each layer being watered, rammed and properly consolidated, before the succeeding one is laid. Each layer shall be consolidated to the satisfaction of Engineer. Earth shall be rammed with approved mechanical compaction machines. Usually no manual compaction shall be allowed unless the Engineer is satisfied that in some cases manual compaction by tampers cannot be avoided. The final backfill surface shall be trimmed and leveled to a proper profile to the approval of the Engineer.

16.2.2 Sand Filling in Plinth and Other Places

At places where backfilling is required to be carried out with local sand it shall be clean, medium grained and free from impurities. The filled-in-sand shall be kept flooded with water for 24 hours and drained to ensure maximum hydraulic compaction. Any temporary work required to contain sand under flooded condition shall be on Contractor's



account. The surface of the consolidated sand shall be dressed to required level or slope. Construction of floors or other structures on sand fill shall not be started until the Engineer has inspected and approved the fill.

16.2.3 Filling in Trenches

Filling in trenches for pipes and drains shall be commenced as soon as the joints of pipes and drains have been tested and passed. The backfilling material shall be properly consolidated by watering and ramming, taking due care that no damage is caused to the pipes.

Where the trenches are excavated in soil, the filling from the bottom of the trench to the level of the center line of the pipe shall be done by hand compaction with selected approved earth in layers not exceeding 8 cm; backfilling above the level of the center line of the pipes shall be done with selected earth by hand compaction, or other approved means in layers not exceeding 15 cm.

In case of excavation of trenches in rock, the filling up to a level 30 cm above the top of the pipe shall be done with approved excavated soil. The filling up to the level of the center line of the pipe shall be done by hand compaction in layers not exceeding 8 cm whereas the filling above the center line of the pipe shall be done by hand compaction or approved means in layers not exceeding 15 cm. The filling from a level 30 cm above the top of the pipe to the top of the trench shall be done by hand or other approved mechanical methods with broken rock filling of size not exceeding 15 cm mixed with fine material as available to fill up the voids.

Filling of the trenches shall be carried out simultaneously on both sides of the pipe to avoid unequal pressure on the pipe.

Item No. 17: Reinforced Cement Concrete Work on the inner side slope and horizontal berm of the phase on Geo net Provided on the Geo textile Liner:

The item includes covering of Geo net liner provided on the Geo textile liner which is applied on the back filled and original cut inner side slopes with RCC M30 to prevent damage of the liners applied on the side slopes and horizontal berm:

- a) Providing and laying in position Ready Mixed M-300 grade concrete for reinforced cement concrete work, using cement content as per approved Design Mix manufactured in fully automatic batching plant and transported to site of work in transit mixer for a lead up to 10 km having continuous agitated mixer, manufactured as per mix design of specified grade for reinforced cement concrete work including pumping of R.M.C. from transit mixer to site of laying, excluding the cost of centring shuttering finishing and reinforcement including cost of admixtures in recommended proportions as per IS: 9103 to accelerate/ retard setting of concrete, improve workability without impairing strength and durability as per direction of the Engineer - in - charge. Without Fly Ash (Min cement level as per latest IS 456 shall be maintained) (Cement level 475 kg)



- b) Supplying, cutting, bending, binding and hooking and binding with wire for RCC work for steel TMT Fe 500 D round bar including bending, binding and placing in position complete all costs up to floor two level as shown in the drawing.
- c) Providing and Laying of Form work with sheeting of steel sheets so as to give a fair finish for concrete structure as shown in the drawing and including centring, shuttering and propping etc. Height of propping and centring below supporting floor to ceiling not exceeding 4 m and removal of the same for in situ reinforced concrete and plain concrete work in: Flat surfaces such as soffits of slabs Landings and the like. (1) Floors etc. up to 200mm in thickness.
- d) Providing and fixing 25 mm thick HD100 Polymer Expansion joint filler board in the expansion joint of the Mass Concrete on Inner Side Slopes at every 48 m of Average Peripheral Length of Side Slope: 25 mm thick HD100 Polymer based expansion joint filler board is a cross linked, pre moulded high performance joint filler board. It is readily compressible and ensures low load transfer. It is a closed cell with excellent chemical resistance, thermally stable up to 70°C, and very compressible as well as elastic with almost more than 90% recoverable to its original state and rot proof and bacteria resistant. The item includes procuring the product, preparation of application system and fixing the product all inclusive.

Item No. 18: Providing and fixing 1.20 Metre high fencing on both sides of top service road and approach ramps:

The Item includes providing and fixing of barbed wire fencing to prevent toppling or falling of vehicles or persons from the top service road as well as approach ramps. It includes providing and fixing 1.20 Metre high fencing with 2.0 m long MS Angle posts 40 mm x 40 mm x 6 mm and oil painting 3 coats fixed at 2.5 m C/C with five horizontal lines and two diagonals of galvanized steel barbed wire weighing 9.38 kg per 100 metre, strained and fixed to posts with G.I. staples including fixing the posts in ground with 0.5 m x 0.5 m x 0.5 m block in CC 1:5:10 etc. complete.



SECTION – 17

ITEM WISE TECHNICAL SPECIFICATIONS FOR LINER WORKS

The specifications described here given are covered in the Schedule of Rates. Relevant IS codes for all the works mentioned below, including specifications for Geo synthetic Clay Liner, HDPE liner, Nonwoven Geo Textile liner and Geo net liner in which they are required to be joined/prepared, procedure for making/laying/fixing of the materials, if any, shall be applicable and the works have to be done as per the specifications and guidelines mentioned therein with relevant tests carried out as specified of the prepared structure and all the materials used in the said work which should be noted and strictly followed as a part of quality assurance program in the construction work. Quality assurance tests and methodology for liner preparation and application shall be as per the quality assurance plan provided separately. Specifications for general items covered in construction of different components of landfill liner systems are described here:

Item No. 19: Providing and laying of 1500 microns virgin quality HDPE geo membrane liner on different areas as described below with heat welding technique:

The item includes providing and laying of 1500 microns virgin quality single layer HDPE liner. The thickness of HDPE geomembrane should not vary across the roll by more than 10 percent. It shall be applied on the clay liner and anchored below the top service road of the landfill. The HDPE liner shall be sealed and packed from both ends with the existing layers by employing comb wedge fusion process. The over lapping between two HDPE sheets shall be minimum 100 mm and the machine welding shall produce two sealing lines between one overlap for perfect sealing of the liner. The lining material shall be of highest quality high density polyethylene (HDPE) sheeting, manufactured in using virgin high density polyethylene resin entirely free of Plasticizers or other filler materials.

The machine should be capable of applying 1000 N pressure and sufficient temperature to produce leak proof seals at the seam on HDPE sheets. Maximum width of the film laid down singly shall not be less than 6 m. The liner so provided shall be tested at CIPET or other government lab or NABL approved laboratories for parameters specified in the quality assurance program. The material shall be supplied and laid with the following criteria:

- The HDPE sheet shall have minimum length of 100 to 140 m and minimum width of 6 to 9 m to reduce the no of welding/seaming points.
- The liner material shall be compatible with chemicals to be contained on site.
- The liner material shall be supplied with non collapsible plastic caps on end of rolls.
- The overlapping and welding area shall be marked with a white line to assure an optimum welding.
- The welding area on the outside edge of the liner shall be smooth.
- The thickness of the HDPE geomembrane shall not vary across the roll by more than 10%.



- The material must be sent with Manufacturer's Test Certificate complying to the acceptable value mentioned below.
- After receipt of the material at site Third Party Test shall be carried out as indicated above.

It should comply all the physico chemical properties as specified below i.e. Tear resistance, Puncture resistance, Tensile strength at yield and break, Carbon black content, density, etc. All the individual sheets shall be tested accordingly. Average Minimum specifications of the HDPE liner is as follow:

Table 1: Specification of 1.50 mm HDPE Smooth Geo membrane:

No.	Property	Test Method	Specified Values
1	Thickness, mm	ASTM D5199	≥ 1.5 mm
2	Density, g/cm ³	ASTM D 1505/D792	≥ 0.94 g/cc
3	Melt Flow Index, g/10 min	ASTM D 1238/D190/5	< 1 g/10 min
4	Tensile Strength at Yield, N/mm	ASTM D 638	≥ 23 kN/m
5	Tensile Strength at Break, N/mm	ASTM D 638	> 43 kN/m
6	Elongation at Yield, %	ASTM D 638	>13
7	Elongation at Break, %	ASTM D 638	> 700
8	Tear Resistance,	ASTM D 1004	≥ 150 N
9	Puncture Resistance, N	ASTM D 5494	≥ 250 N
10	Oxidative Induction time (OIT)	ASTM D 3895	100 min.
11	UV Resistance	-	Yes
12	ESCR, 100 hours	ASTM D 1693	Pass
13	Dimensional Stability after warm storage 1 hr/100 °C, %	ASTM D 1024	± 2%
14	Carbon Black Content %	ASTM D 1603 - 94	≥ 2%
15	Carbon Black Dispersion, Category	ASTM D 5596 – 94	Cat. 1 -2
16	Seam Strength (Shear)	ASTM D 4437	≥ 90% of parent material
17	Seam Strength (Peel)	ASTM D 4437, D413	≥ 60% of parent material
18	Roll Width, m	-	Min. 6 to 9 m
19	Chemical Resistance		Resistant to most strong acids and alkalis

The measurements shall be taken of the covered area only and no overlaps as well as wastage of the material will be considered. The HDPE liner at the outer most edge shall be jammed below the rubble layer on the service road and compacted to provide for proper holding of the liner. The details are shown in the drawing.



Testing of HDPE liner:

Agency shall get the following tests done in CIPET or other government LAB or NABL approved laboratories as per the Test Protocol given below.

Sampling:

- Sampling is to be done from rolls. The sample shall be 1 m in width. For HDPE smooth sample size shall be as per Testing Laboratory requirement.
- The average of the test result should be calculated per the particular standard cited and compared to the average values listed out in table 1.
- In case differences beyond the normal tolerances and fluctuations experienced usually are found in the tests, the Supplier shall be given the right to explain his test methods and how discrepancies can occur, for consideration of the Purchaser. The purchaser shall consider it accordingly for evaluation and then decide on acceptance/rejection.
- Tests may be conducted at the Purchaser's discretion at an external independent laboratory. Frequency of such tests shall be @ every 5,000 Sq.m. or Per Lot whichever is less. However, minimum 5 Nos. of samples shall be tested for the liner in any case.

Retest and Rejection

If the test results of any test do not conform to the requirements of this specification, retesting to determine conformance or rejection should be done.

Transportation and On-site Storage

The geomembrane rolls shall be shipped by flatbed trailer to the job site. The geomembrane shall be stored so as to be protected from puncture, dirt, grease, moisture, and excessive heat. Damaged material shall be stored separately for repair or replacement. The rolls shall be stored on a prepared smooth surface (not wooden pallets) and should not be stacked more than two rolls high.

Earthwork

General

The owner or his representative (soil quality assurance engineer) shall inspect the subgrade preparation. Prior to liner installation the subgrade shall be compacted in accordance with the project specifications. Weak or compressible areas which cannot be satisfactorily compacted should be removed and replaced with properly compacted fill. All surfaces to be lined shall be smooth, free of all foreign and organic material, sharp objects, or debris of any kind. The subgrade



shall provide a firm, unyielding foundation with no sharp changes or abrupt breaks in grade. Standing water or excessive moisture shall not be allowed.

Anchor Trench

The anchor trench shall be excavated to the line, grade, and width shown on the project construction drawings, prior to liner system placement. Slightly rounded corners shall be provided in the trench to avoid sharp bends in the geomembrane. If anchor trench is not used, it may be sandwiched between the base of the top service road and the RCC layer.

Method of Placement

The rolls shall be deployed using a spreader bar assembly attached to a loader bucket or by other methods approved by the project-in-charge.

The installer shall be responsible for the following:

1. Equipment or tools shall not damage the geomembrane during handling, transportation and deployment.
2. Personnel working on the geomembrane shall not smoke or wear damaging shoes.
3. The method used to unroll the panels shall not cause scratches or crimps in the geomembrane and shall not damage the supporting soil.
4. Adequate loading (e.g., sand bags or similar items that will not damage the geomembrane) shall be placed to prevent uplift by wind (in case of high winds, continuous loading is recommended along edges of panels to minimize risk of wind flow under the panels).

Field Seaming

Approved seaming processes are fusion and extrusion welding. On side slopes, seams shall be oriented in the general direction of maximum slope, i.e., oriented down, not across the slope. In corners and odd-shaped geometric locations, the number of field seams shall be minimized. No base T-seam shall be closer than 5 feet from the toe of the slope. Seams shall be aligned with the least possible number of wrinkles and "fish mouths". If a fish mouth or wrinkle is found, it shall be relieved and cap-stripped. Seaming shall be completed by wedge welding with single air channel for all welds and extrusion weld only for repairs and where wedge welding cannot be performed.

Test Seams

Field test seams shall be conducted on the liner to verify that seaming conditions are satisfactory.

Test seams shall be conducted at the beginning of each seaming for each seaming apparatus.



Performing filed Quality Assurance Checks at site only by Air Pressure Tests, Vacuum pressure tests, Shear Tests and Peel Tests

Acceptance / Rejection:

- Geomembrane not meeting the requirements of these Technical Specifications shall be rejected and not be delivered to the site or upon knowledge of defects, shall be removed from the site within 15 working days.
- The Purchaser will issue Receiving Certificates at the Site after reception of the Geomembrane, verifying the quantities and the completeness of all related test certificates and the compliance of the test certificates with these Technical Specifications within 7 days from receipt of materials at the Stores. The Receiving Certificate qualifies the Supplier for payment in accordance with the payment schedule.

Method of Measurement:

The Geomembrane supplied shall be measured in square meter. The measurements shall be taken of the covered area only and no overlaps or wastage of material will be considered.

Item No. 20: Providing and Laying of 500 GSM PP Non-Woven Geotextile on Drainage Layer on the bottom of the Phase for preventing Clogging of the drainage layer by leachate solids:

The item includes providing and laying of 500 GSM virgin quality Polypropylene Fiber Needle Punched Nonwoven Geo textile liner manufactured through machine made process of heat bonding or needle punching techniques to be laid over drainage layer on the bottom of the phase to prevent clogging of the layer. The over lapping between two Geo textile sheets shall be minimum 100 mm.

Maximum width of the film laid down singly shall not be less than 4 m. The liner so provided shall be tested at CIPET or government laboratory or other NABL approved laboratory for parameters specified in the quality assurance program.

It should comply all the physico chemical properties as specified i.e. Tear resistance, Puncture resistance, Tensile strength, Mass per unit area, UV resistance, etc. The measurements shall be taken of the covered area only and no overlaps will be considered. The details are shown in the drawing. Additional criteria and specifications of the material shall be as follow:

**1 Material**

The needle punched nonwoven Geo textile shall be used as protection layer above Geo membrane. The Geo textile shall be made of Polypropylene fibers manufactured through machine made process of heat bonding or needle punching techniques. The Average Roll Values of Geo textile shall be as shown in table 2.

Table 2 Properties of 500 GSM Geo textile Liner:

Property	Test Method	Average Value
Mass per Unit Area, g/m ²	ASTM D 5261	500
Thickness, mm	ASTM D 5199	3.20
Tensile Strength, kN/m	ASTM D 4595	36.0
Grab Tensile Strength, N	ASTM D 4632	1700
Elongation Break, %	ASTM D 4595	50-75
CBR Puncture Resistance, N	ASTM D 6241	5100
AOS, Microns	ASTM D 4751	<75
Permeability, Lit/m ² /sec	ASTM D 4491	30
Tear Strength, N	ASTM D 4533	700
UV Resistance, %	ASTM D 4355	70
Roll Length, m		50
Roll Width, m		4/6

Note:

The values are average roll values in which all the properties are likely to have ±10% tolerances. Water Permeability, Elongations are likely to have -30% tolerance and Apparent Opening Size (AOS) have + 30%.

2 Method of measurement

Quantity of filter Geo textile shall be determined from cross sections and the linear distance, and paid for under the appropriate contract items. The measurements shall be taken of the covered area only and no overlaps will be considered.

**3 Eligibility of Manufacturer / Supplier**

The Geo textile shall meet the minimum requirements as mentioned above. Geo textile shall be procured only from an Indian suppliers / Indian authorized Distributor. The Geo textile manufacture / Supplier shall be ISO 9001: 2008 certified. General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and or/ documents.

4 Storage and Handling of Geo textile

Each roll delivered to site shall be clearly labeled with grade, batch number and wrapped in material that will protect the Geo textile including the ends of rolls from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during shipment and storage. During storage, Geo textile rolls shall be elevated off the ground and adequately covered to protect them from site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 50°C, and any other environmental condition that may damage the physical property values of the Geo textile.

5 Basis of Payment

Accepted Geo textile shall be paid for at the unit price (per square meter area) for each pay item included in the contract. The measurements shall be taken of the covered area only and no overlaps will be considered.

6 Method of Testing

The supplier has to submit a Quality conformity certificate and Manufactures test certificate for the parameters indicated in table 1 for every lot/shipment.

Item No. 21: Providing and Laying of 1200 GSM PP Non-Woven Geo textile above HDPE liner as Protection Layer

The item includes providing and laying of 1200 GSM virgin quality Polypropylene Fiber Needle Punched Nonwoven Geo textile liner manufactured through machine made process of heat bonding or needle punching techniques to be laid over HDPE Liner to protect the HDPE liner. It shall be applied on the bottom and inner side slopes over HDPE Liner. It shall be sealed and packed



from both ends with the existing layers and fused with weaving the liner. The over lapping between two Geo textile sheets shall be minimum 100 mm.

Maximum width of the film laid down singly shall not be less than 4 m. The liner so provided shall be tested at CIPET or government laboratory or other NABL approved laboratory for parameters specified in the quality assurance program.

It should comply all the physico chemical properties as specified i.e. Tear resistance, Puncture resistance, Tensile strength, Mass per unit area, UV resistance, etc. The measurements shall be taken of the covered area only and no overlaps will be considered. The details are shown in the drawing. Additional criteria and specifications of the material shall be as follow:

1 Material

The needle punched nonwoven Geo textile shall be used as protection layer above Geo membrane. The Geo textile shall be made of Polypropylene fibers manufactured through machine made process of heat bonding or needle punching techniques. The Average Roll Values of Geo textile shall be as shown in table 3.

Table 3 Properties of 1200 GSM Geo textile Liner:

Property	Test Method	Average Value
Mass per Unit Area, g/m ²	ASTM D 5261	1200
Thickness, mm	ASTM D 5199	6
Tensile Strength, kN/m	ASTM D 4595	55
Grab Tensile Strength, N	ASTM D 4632	3600
Elongation Break, %	ASTM D 4595	70
CBR Puncture Resistance, N	ASTM D 6241	13000
AOS, Microns	ASTM D 4751	<70
Permeability, Lit/m ² /sec	ASTM D 4491	3
Tear Strength, N	ASTM D 4533	2550
UV Resistance, %	ASTM D 4355	>50% strength retention
Roll Length, m		25
Roll Width, m		4/5



Note:

The values are average roll values in which all the properties are likely to have $\pm 10\%$ tolerances. Water Permeability, Elongations are likely to have -30% tolerance and Apparent Opening Size (AOS) have + 30%.

2 Method of measurement

Quantity of filter Geo textile shall be determined from cross sections and the linear distance, and paid for under the appropriate contract items. The measurements shall be taken of the covered area only and no overlaps will be considered.

3 Eligibility of Manufacturer / Supplier

The Geo textile shall meet the minimum requirements as mentioned above. Geo textile shall be procured only from an Indian suppliers / Indian authorized Distributor. The Geo textile manufacture / Supplier shall be ISO 9001: 2008 certified. General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and or/ documents.

4 Storage and Handling of Geo textile

Each roll delivered to site shall be clearly labeled with grade, batch number and wrapped in material that will protect the Geo textile including the ends of rolls from damage due to shipment, water, sunlight and contaminants. The protective wrapping shall be maintained during shipment and storage. During storage, Geo textile rolls shall be elevated off the ground and adequately covered to protect them from site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 50°C, and any other environmental condition that may damage the physical property values of the Geo textile.

5 Basis of Payment

Accepted Geo textile shall be paid for at the unit price (per square meter area) for each pay item included in the contract. The measurements shall be taken of the covered area only and no overlaps will be considered.



6 Method of Testing

The supplier has to submit a Quality conformity certificate and Manufactures test certificate for the parameters indicated in table 1 for every lot/shipment

Item No. 22: Providing and Laying of 5 Kg/Sq.m. Sodium Bentonite based Geo synthetic Clay Liner on Bottom and Inner Side Slopes of the Phase:

The item includes providing and laying of Sodium bentonite Based Geo synthetic Clay liner comprising of lower layer made from virgin quality Polypropylene Fiber Needle Punched Nonwoven Geo textile liner manufactured through machine made process of heat bonding or needle punching techniques and upper layer made from virgin quality Polypropylene Fiber Needle Punched Woven Geo textile liner with filling of Sodium Bentonite with a mass of 5 Kg/Sq.m. to allow the permeability of the liner to be reduced to the desired permeability required for landfill projects. It is to be laid before laying of HDPE Liner and shall serve as a first barrier to prevent leachate flowing through the liner system. It shall be applied on the bottom over the clay liner as well as on inner side slopes. It shall be sealed and packed from both ends with the existing layers and fused with weaving the liner. The over lapping between two GCL sheets shall be minimum 100 mm.

Maximum width of the film laid down singly shall not be less than 5 m. The liner so provided shall be tested at CIPET or government laboratory or other NABL approved laboratory for parameters specified by the AMC&/or its authorized persons.

It should comply all the physico chemical properties as specified i.e. Tear resistance, Puncture resistance, Tensile strength, Mass per unit area, UV resistance, Hydraulic conductivity etc. The measurements shall be taken of the covered area only and no overlaps will be considered. The details are shown in the drawing. Additional criteria and specifications of the material shall be as follow:

**1 Material**

The Average Roll Values of Geo synthetic Clay liner shall be as shown in table 4.

Table 4 Properties of 5 Kg/Sq.m. Sodium Bentonite based Geo synthetic Clay Liner:

Property	Test Method	Average Value
Geo textile Property		
Cap Non-Woven PP –Mass per Unit Area, g/m ²	EN ISO 9864	200
CarrierWoven PP –Mass per Unit Area, g/m ²	EN ISO 9864	125
Sodium Bentonite Properties		
Montmorillonite content, %	XRD Analysis	85
Swell Index, ml/2g	ASTM D 5890	25
Fluid Loss, ml	ASTM D 5891	17
Finished GCL Properties		
Bentonite mass per unit area @ 12% moisture content, Kg/Sq.m.	EN 14196	5
Bentonite mass per unit area @ 0% moisture content, Kg/Sq.m.	EN 14196	4.4
Hydraulic Conductivity, m/s	ASTM D 5887	2×10^{-11}
Index Flux, m ³ /m ² /s	ASTM D 5887	5×10^{-9}
Tensile Strength - MD, kN/m	ASTM D 6768	12
Tensile Strength - CMD, kN/m	ASTM D 6768	12
Strain at Max. Load–MD, CMD, %	ASTM D 6768	≤30
Static Puncture Strength, KN	EN ISO 12236	2.2
Peel strength – MD, N/10cm	ASTM D 6496	65
Roll Length/Width, m		40/5
Thickness, mm	EN ISO – 9863 -1	6

**2 Method of measurement**

The measurements shall be taken of the covered area only and no overlaps will be considered.

3 Basis of Payment

Accepted GCL shall be paid for at the unit price (per square meter area) for each pay item included in the contract. The measurements shall be taken of the covered area only and no overlaps will be considered.

6 Method of Testing

The supplier has to submit a Quality conformity certificate and Manufactures test certificate for the parameters indicated in table 4 for every lot/shipment

Item No. 23: Providing and laying of 150 gsm thick unprocessed PP nonwoven Geo textile liner on the perforated HDPE leachate collection pipe to allow leachate to flow to the leachate collection well:

The item includes providing and laying of 150 GSM virgin quality Polypropylene Fiber Needle Punched unprocessed Nonwoven Geo textile liner manufactured through machine made process of heat bonding or needle punching techniques to be laid over 160 mm lateral perforated HDPE pipes for leachate collection and wrapped on the pipe. This shall permit high flow of leachate into the leachate collection pipes and shall carry leachate to the leachate well. The liner shall be placed over the leachate collection pipe system. The liner shall be covered with 300 mm thick layer of gravels as used in drainage layer. Each layer need to be applied and compacted with a light weight dozer or roller to make a compact layer.

The specifications for 150 gsm Geo textile liner are as follow:

Property	Test Method	Average Value
Mass per Unit Area, g/m ²	ASTM D 5261	150
Thickness, mm	ASTM D 5199	1.20
Tensile Strength, kN/m	ASTM D 4595	9
Grab Tensile Strength, N	ASTM D 4632	525
Elongation@Break, %	ASTM D 4595	50-95
CBR Puncture Resistance, N	ASTM D 6241	1100

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AOS, Microns	ASTM D 4751	160
Permeability, Lit/m ² /sec	ASTM D 4491	230
Tear Strength, N	ASTM D 4533	190
UV Resistance, %	ASTM D 4355	70
Roll Length, m		50
Roll Width, m		2/4/6

Note:

The values are average roll values in which all the properties are likely to have $\pm 10\%$ tolerances. Water Permeability, Elongations are likely to have -30% tolerance and Apparent Opening Size (AOS) have + 30%.

Method of measurement

Quantity of Nonwoven Geo textile liner shall be in terms of Square meters. The measurement shall be taken of the covered area only and no overlaps will be considered.

Item No. 24: Providing and Laying of Biplanar Geo net made from HDPE material having thickness of 6.2 mm at 20kPa and Mass per Unit area of 720 GSM to be laid on Geo textile Liner on Side Slope to act as a base for laying Concrete on the geo textile liner.

The item includes Providing and Laying of Biplanar Geo net made from HDPE material having thickness of 6.2 mm at 20kPa and Mass per Unit area of 720 GSM to be laid on Geo textile Liner on Side Slope to act as a base for laying Concrete on the geo textile liner.

Standard Specifications for Geo net:**1. Scope**

This generic specification covers biplanar Geo nets for subsequent use in transmitting liquids within the manufactured plane of the materials. This specification sets forth a set of physical, mechanical, hydraulic, and endurance properties that must be met, or exceeded by the product being manufactured. This standard specification is intended to assure good quality and performance of the Geo net. Additional tests, or more restrictive values for the tests indicated, may be necessary under conditions of a particular application.

2. Material Classification and Formulation

This specification covers Geonets of the biplanar type. The Geo nets covered in this specification are made from a formulation consisting of high density polyethylene (density > 0.950g/cc), in a weight percentage of approximately 97%, with about 2% carbon black, and the remainder being antioxidants for protection during extrusion and long-term service performance. The resin shall be virgin material with no more than 25% rework. If rework is used, it must be a similar formulation as the parent material. No post consumer resin (PCR) of any type shall be added to the formulation.

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The finished Geo net product shall have good appearance qualities. It shall be free from such defects that would affect the specific properties of the Geo net or its proper functioning. General manufacturing procedures shall be performed in accordance with the manufacturer's internal quality control guide and/or documents.

4. Shipment and Storage

Geo net labeling, shipment, and storage shall follow ASTM D 4873. Product labels shall clearly show the manufacturer or supplier name, style, and roll number. Each shipping document should include anotation certifying that the material is in accordance with this specification. Each Geo net roll shall be wrapped with a material that will protect the Geo net(s) including the ends of the roll, from damage due to shipment, water, sunlight and contaminants. The protective wrappings shall be maintained during periods of shipment and storage. Geo net rolls shall be elevated off the ground during storage. Alternatively, rolls can be stored on clean concrete or asphalt pavement without being elevated off the ground surface. In all cases, they should be adequately covered to protect them from the following: construction damage, precipitation, extended ultra violet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, temperatures in excess of 160°F (71 °C), root intrusion, and any other environmental condition that may damage the property values of the product involved.

5. Certification

The contractor shall provide to the engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the Geo net and other pertinent information of fully describe the product. The manufacturer is responsible for establishing and maintaining a quality control program to assure compliance with the requirements of the specification. Documentation describing the quality control program shall be made available upon request. The manufacturer's certificate shall state that the finished Geo net meets minimum average values requirements of the specification as evaluated under the manufacturer's quality control program. A person having legal authority to bind the manufacturer shall attest to the certificate. Either mislabeling or misrepresentation of materials shall be reason to reject the products involved in this specification.

6. Geo net Properties

Property	Unit	Test method	Value
Polymer	HDPE		
Thickness at 20kpa/200kpa	Mm	EN964	6.2/5.8
Thickness reduction due to creeping	%	EN1897	<3
Mass per unit area	Gm/m	EN965	720
Peak tensile strength, MD/CD	Kn/m	ISO10319	5.0/2.0
Elongation at break, MD/CD	%	ISO10319	20/90
Crushing resistance	Kpa	ASTM D1621	>1.10

SECTION – 18

**ITEM WISE TECHNICAL SPECIFICATIONS FOR NEW WORKS****ITEM NO. B: CONSTRUCTION OF LEACHATE TREATMENT PLANT OF 60 KLD CAPACITY:**

The item includes Providing, Constructing and Operation of 60 KLD Capacity Leachate Treatment Plant (LTP) with Primary, Secondary and Tertiary Treatment of Leachate generated from the landfill site and treating it to the level of discharge permissible standards into the drain leading to the STP. Operation and Maintenance of LTP as Constructed shall be for a period of 5 years including all the costs involving Overhauling/retrofitting works with increase in O& M cost every year @10% of the previous year charges.

A) DESIGN BASIS:

1) Total Inlet Flow: 60 KLD or 60000 Lit/Day

2) Operational Hours of ETP: 12 hours per day

Parameters	Unit	Raw Water/Inlet	Treated Water/Outlet
pH	-	5 - 7	6.5 – 8.5
Chemical Oxygen Demand (COD)	mg/L	< 5000	<500
Bio Chemical Oxygen Demand (BOD)	mg/L	< 1500	<100
Total Suspended Solids (TSS)	mg/L	< 1500	<200
Oil and Grease	mg/L	< 100	<10
Total Dissolved Solids	mg/L	<2100	No Change

3. MAJOR TREATMENT UNITS INVOLVED:**3.1 Primary Treatment:****1. Equalization Tank**

Balances fluctuations in flow, pH, and pollutant load to provide a uniform feed to downstream units.

2. DAF (Dissolved Air Flotation) System

Coagulant and flocculant are dosed and mixed through inline static/pipe flocculation, promoting formation of dense, settleable/flotable flocs. Ensures effective aggregation before entering DAF. Air-saturated water is released to form microbubbles that attach to flocs, causing them to float for surface removal by skimmer. Clarified water is collected from DAF and sent for further biological treatment.

**3.2 Biological/Secondary Treatment:**

To achieve the desired concentration of BOD & COD in the treated wastewater, it's proposed to install two stage biological process with extended aeration technology. In this mixed micro-organism culture developed in the suspended forms, which degrade the organic matter present in the wastewater in the presence of air and convert it into more simple compound and at end CO₂ and new bacteria. Air supplied to aeration tank through fine bubble diffuser aeration system.

Each aeration tank followed with the secondary settling tank where the suspended particles (MLSS) settles at bottom. To increase the surface loading rate we have proposed to install tube type settler. This sludge is recycled back to aeration tank through sludge recycle pump & excess sludge vested to the sludge sump. Supernatant from secondary settling tank transfer to the intermediate collection tank.

3.3 Tertiary treatment:

Overflow from the secondary settling tank will collect into intermediate collection tank & further treated in tertiary treatment as polishing treatment.

1. Pressure sand filter:

From the intermediate collection tank wastewater is pumped to pressure sand filter to remove the small size particle through filtration process.

2. Activated carbon filter:

Activated carbon has high adsorption capacity. We have proposed to used 1100 iodine value carbon to remove the residual impurity from the treated waste water. Further this treatment helps to remove colour & odour from treated waste water.

3. Disc Filter:

Provides final polishing by removing fine suspended particles escaping from Pressure Sand Filter (PSF) and Activated Carbon Filter (ACF). Operates with microscreen discs and automatic backwash to ensure consistent low turbidity outlet.

4. Final collection tank & chlorination:

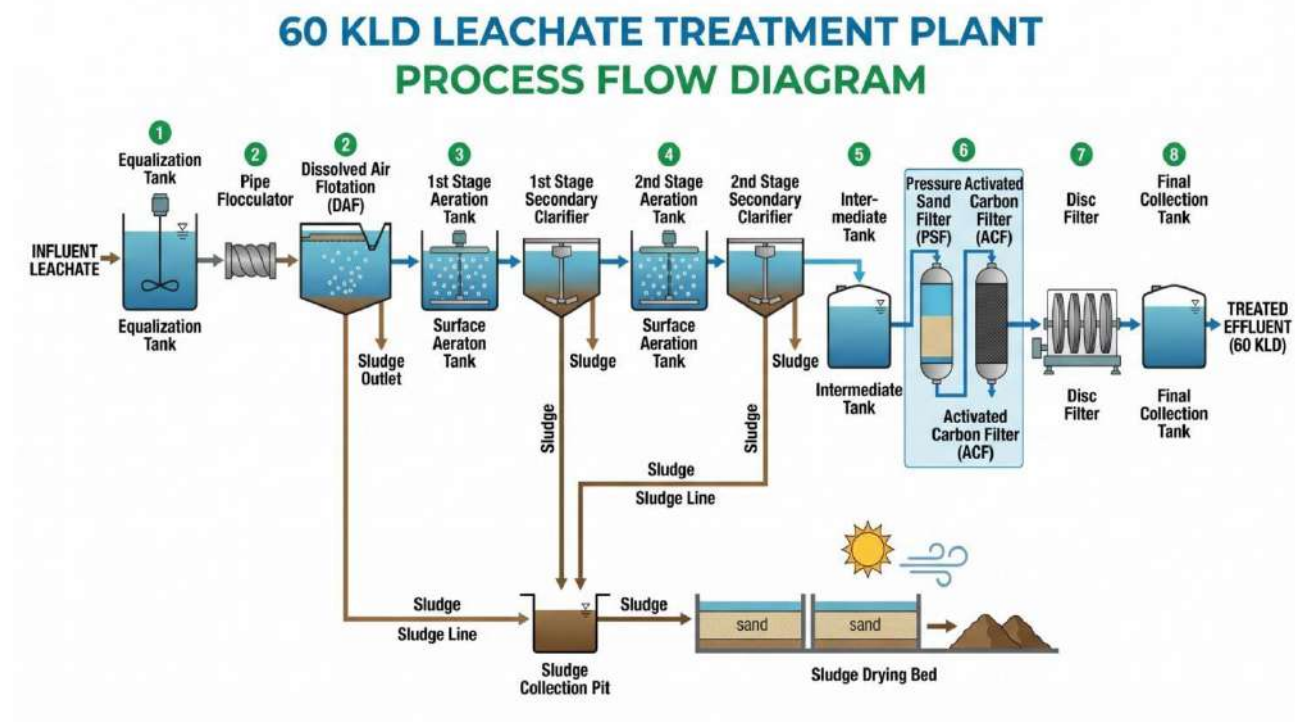
After the treatment into the ACP treated water is collected in final collection tank where chlorine dosing will be done for disinfection of waste water. This treated water will be utilized for back washing of ACF & PSF. Back wash water transferred to the equalization tank, remaining treated waste water will be discharged to the near by nala.



5. Sludge drying bed:

Sludge which is generated from DAF& two stage secondary settling tank transferred to the sludge drying bed either through sludge sump or directly to sludge drying bed. In this sludge drying bed 50% water filtrate through the filtration and same will be recycled back to the equalization tank. Further solar drying will help to de-water the sludge. Dry sludge will be transferred to the municipal solid waste dump site.

B) PROCESS FLOW DIAGRAM:



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C. Technical Details of Civil units**1. Equalization Tank**

Balances fluctuations in flow and pollutant load.

Sr.No.	Description	Unit	Size/ Number/ Specification
1	Average Flow	m3/hr	5
2	Retention Time	hr	6
3	Effective Storage Volume	m3	30
4	Depth of Tank	m	2.0
5	Dimension of Tank	m	3.2 x 4.8 x (2.0 SWD + 0.5 FB)
6	MOC	-	Pre-fabricated MS + Internal FRP Coating

2. Pipe Flocculator

Replaces traditional flash mixers and flocculator tanks. Promotes inline mixing of coagulant/flocculant before the DAF unit.

Sr.No.	Description	Unit	Size/ Number/ Specification
1	Flow In Unit	m3/hr	5
2	Mixing Type	-	Inline Static / Serpentine Pipe
3	Retention Time	Min	2 to 5
4	MOC	-	UPVC / FRP

3. Dissolved Air Flotation (DAF) System

Replaces the primary settling tank. Removes lightweight flocs, suspended solids, and oil/grease via microbubble flotation.

Sr.No.	Description	Unit	Size/ Number/ Specification
1	No of Units	No.	1
2	Flow	m3/hr	5
3	Surface Loading Rate	m3/m2/hr	8
4	Skimmer Mechanism	-	Mechanical chain & flight scraper
5	MOC	-	Pre-fabricated MS + Internal FRP Coating

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4. 1st Stage Aeration Tank

Sr.No.	Description	Unit	Size/ Number/ Specification
1	No of Units	No.	1
2	Flow In Unit	m ³ /d	60
3	MLSS	mg/l	4000-5000
4	Provided Volume	m ³	168
5	Recirculation ratio		1:1
6	Retention Time	Hours	~34
7	Dimension of tank	m	6.0 x 8.0 x (3.5 SWD + 0.5 FB)
8	MOC	-	Pre-fabricated MS + Internal FRP Coating

5. 1st Stage Secondary Clarifier

Sr.No.	Description	Unit	Size/ Number/ Specification
1	No of Units	No.	1
2	Flow	m ³ /h	10
3	Surface Loading Rate	m ³ /m ² /day	20
4	Total Depth	m	4.0
5	Size of SST	m	3.0 x 2.0 x (3.5 SWD + 0.5 F.B.)
6	MOC	-	Pre-fabricated MS + Internal FRP Coating

6. 2nd Stage Aeration Tank

Sr.No.	Description	Unit	Size/ Number/ Specification
1	No of Units	No.	1
2	Flow In Unit	m ³ /d	60
3	Provided Volume	m ³	94
4	Recirculation ratio		1:1
5	Retention Time	Hours	19
6	Dimension of tank	m	4.5 x 6.0 x (3.5 SWD + 0.5 FB)
7	MOC	-	Pre-fabricated MS + Internal FRP Coating

7. 2nd Stage Secondary Clarifier

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Sr.No.	Description	Unit	Size/ Number/ Specification
1	No of Units	No.	1
2	Flow	m ³ /h	5
3	Total Depth	m	4.0
4	Size of SST	m	3.0 x 2.0 x (3.5 SWD + 0.5 F.B.)
5	MOC	-	Pre-fabricated MS + Internal FRP Coating

8. Intermediate Collection Tank

Sr.No.	Description	Unit	Size/ Number/ Specification
1	No of Units	No.	1
2	Retention time in Tank	Hr.	6
3	Volume of Tank	m ³	30
4	Dimension of Tank	m	3.2 x 4.8 x (2.0 SWD + 0.5 F.B.)
5	MOC	-	Pre-fabricated MS + Internal FRP Coating

9. Disc Filter

Provides final polishing by removing fine suspended particles escaping from tertiary filters.

Sr.No.	Description	Unit	Size/ Number/ Specification
1	No of Units	No.	1
2	Maximum Flow rate	m ³ /hr	5 to 6
3	Filtration Rating	Microns	10 - 20 (as per selection)
4	Backwash	-	Automatic / Pressure controlled
5	MOC	-	SS 316 / High-grade polymer discs

10. Final Collection Tank

Sr.No.	Description	Unit	Size/ Number/ Specification
1	No of Units	No.	1
2	Retention time in Tank	Hr.	2
3	Volume of Tank	m ³	10
4	Dimension of Tank	m	1.4 x 2.2 x (3.7 SWD + 0.3 F.B.)
5	MOC	-	Pre-fabricated MS + Internal FRP Coating

11. Sludge Collection Sump

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Sr.No.	Description	Unit	Size/ Number/ Specification
1	Total Volume	m ³	1.0
2	Dimension of Tank	m	1.0 x 1.0 x 1.0
3	MOC	-	Pre-fabricated MS + Internal FRP Coating

12. Sludge Drying Bed

Sr.No.	Description	Unit	Size/ Number/ Specification
1	No of Units	No.	4
2	Total Depth	m	1.5
3	Sludge Application depth	m	0.3
4	MOC	-	Civil Brick work / Concrete

D. TECHNICAL DETAILS OF ELECTRO-MECHANICAL ITEMS**1. Raw Waste Water Transfer Pumps**

- **Make:** Kirloskar / KSB / CNP India
- **Type:** Centrifugal non-clog type
- **Flow:** 6 m³/hr
- **Head:** 8 m
- **Qty:** 2 No. (1 W + 1 S.B.)

2. DAF Feed & Recirculation System

- **Feed Pump:** Centrifugal, 6 m³/hr
- **Air Compressor:** Reciprocating type for air dissolving tube
- **Qty:** 1 Lot

3. Sludge Recycle Pumps

- **Make:** Kirloskar / KSB / CNP India
- **Flow:** 6 m³/hr
- **Head:** 10 m
- **Qty:** 4 No. (2 Working + 2 Standby)

4. Filter Feed Pumps

- **Flow:** 5 m³/hr
- **Head:** 25 m
- **Qty:** 2 No. (1 W + 1 S.B.)

5. Air Blowers (For Aeration)



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- **Type:** Twin lobe rotary; Positive Displacement
- **Capacity:** 100 m³/Hr
- **Pressure:** 0.5 Kg/Cm²
- **Qty:** 2 No. (1 W + 1 S.B.)

6. Multi Grade Pressure Sand Filter (PSF)

- **Flow Rate:** 5 m³/hr
- **Vessel Dimension:** 500 mm Dia x 1200 mm Height
- **MOC:** FRP Vessel, CI Butterfly Valves, UPVC Piping

7. Activated Carbon Filter (ACF)

- **Flow Rate:** 5 m³/hr
- **Vessel Dimension:** 500 mm Dia x 1200 mm Height
- **Filter Media:** Activated Carbon (1100 Iodine value proposed)
- **MOC:** FRP Vessel

8. Air Diffusers

- **Type:** Tube Type / Disc Type (EPDM Membrane)
- **Size:** Dia. 90mm x 1000 mm Length
- **Nominal Air Flow:** 10 cum/hr per Diffuser

9. Hypochlorite Dosing Pump

- **Capacity:** 0-1 m³/hr
- **Pressure:** 10 kg/cm²
- **Preparation Tank:** 200 L Sintax Make

10. Control Panel

- **Cabinet:** 16 Gauge sheet metal with powder coating
- **Protection:** Weather proof IP-52

11. Piping & Valves – 1 lot

12. Cabling – 1 lot

13. Misc. items – 1 lot

ITEM NO. C: CONSTRUCTION OF FIRE FIGHTING SYSTEM:

The item includes Providing, Laying and Construction of Fire Fighting System comprising of External Fire Hydrant System including the supply and commissioning of the fire fighting network around landfill site with provision of necessary fire pumps, piping, hydrant points as well as provision of 5 Lakh litre Capacity Fire Water Storage Tank complete.

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It includes Providing and Laying of External Hydrant System including the supply and commissioning of the fire fighting network around SLF and providing equivalent pump and pipe and hydrant point from the provided 5Lac Litre fire water tank.

It also includes the following items to be procured and installed on the site:

SR NO	PRODUCT DESCRIPTION	QUANTITY	UNITS
1	Supply Installation and Commissioning of Fire Main Pump, 50 Hp	01	Nos.
2	Supply Installation and Commissioning of Fire Diesel Pump, 50 Hp	01	Nos.
3	Supply Installation and Commissioning of Jockey Pump, 7.5 Hp	01	Nos.
4	Supply Installation and Commissioning of Automatic Control Panel for Pumps	01	Nos.
5	Supply Installation of Foot Valve (100 mm)	03	Nos.
6	Supply Installation of Foot Valve (80 mm)	05	Nos.
7	Supply Installation of Butterfly Valve (100 mm)	04	Nos.
8	Supply Installation of Butterfly Valve (80 mm)	02	Nos.
9	Supply Installation of NRV Dual Plate (100 mm)	02	Nos.
10	Supply Installation of NRV Dual Plate (80 mm)	01	Nos.
11	Supply Installation of Pressure Gauge as per fire safety norms	04	Nos.
12	Supply Installation of Pressure Switch as per fire safety norms	03	Nos.
13	Supply Installation of Ball Valve (25 mm)	02	Nos.
14	Supply Installation of Ball Valve (20 mm)	20	Nos.
15	Supply Installation of Ball Valve (15 mm)	04	Nos.
16	Supply Installation of Sprinklers	26	Nos.
17	Supply Installation and Commissioning of Hydrant Valves	100	Nos.
18	Supply Installation and Commissioning of RRL Type Hose Pipe (15 m)	100	Nos.
19	Supply Installation and Commissioning of Hose Box	100	Nos.
20	Supply Installation and Commissioning of Short Branch Pipes	100	Nos.
21	Supply Installation and Commissioning of 2 way Fire Brigade Inlet	1	Nos.
22	Supply Installation and Commissioning of 150 mm MS B Class Fire Hydrant Line Pipes including accessories such as MS Bracket, U Clamp tees, elbows, reducers, coupling, flanges etc. with one coat of red oxide primer and two coats of synthetic enamel paint (P.O. Red)	300	M
23	Supply Installation and Commissioning of 100 mm MS B Class Fire Hydrant Line Pipes including accessories such as MS Bracket, U Clamp tees, elbows, reducers, coupling, flanges etc. with one coat of red oxide primer and two coats of synthetic enamel paint (P.O. Red)	1200	M
24	Cable for Pressure Switch	3	M
25	Supply Installation and Commissioning of Structural Supports like MS Angle, Channel etc.	13000	Kg
26	Bend, flange, Reducer, nut bolt etc. fittings accessories	2	Lot
27	Wrapping and Coating for Underground Pipes as Anticorrosive treatment	100	M
28	Cable for Pumps	1	Lot
29	Obtaining Fire Fighting NOC from the applicable authorities	1	Nos.
30	5 Lakh Litre Capacity Fire Water Tank as per BOQ given	1	Nos.
31	1.5 Lakh Litre Capacity Fire Water Tank as per BOQ given	1	Nos.

**SECTION – 19****QUALITY ASSURANCE PLAN FOR CONSTRUCTION OF SECURED LANDFILL****Quality Assurance Principles**

Quality in construction of the Secured landfill facility has to be ensured to match highest standards. The basic purpose is to minimize the possibility of deviation from design specifications. To ensure the quality of the overall structure of the Secured Landfill facility, the individual components must meet the quality standards. Quality assurance must relate to both the quality of the materials used and the workmanship in accordance with the existing state of technology. Quality assurance is particularly important during the use of minerallic clay in landfill sealing system. The clay must conform to the quality specifications described in the Tender documents. Therefore, at each and every stage of construction, the construction procedure, specifications of materials used and the tests results have to be documented.

The Quality assurance planning mainly involves

- Quality Assurance before the start of Construction – quality control of soil used for earthen bunds, quality control of different civil materials used for construction etc.
- Quality assurance during preparation and placement of clay liner
- Quality Assurance during the placement of Geo synthetic Clay Liner, HDPE Geo membrane and Geo textile liners in the landfill
- Quality assurance during leachate collection system
- Quality assurance during placement of top cover liner system including top cover soil.
- Documentation of all quality control records to be submitted to concerned authorities
- Checking of the list of the tests to be carried out during landfill construction to regulatory authority and get approved before start of construction. It also involves inviting of regulatory authorities periodically during construction of landfill and submission of the complete documentation to the regulatory authorities in time.
- Photographs and videos at every stage of construction and testing have to be taken and documented.

1.1 Quality assurance planning before start of construction.

Before the start of construction activity, the sources of raw materials to be procured from shall be finalized. Later on there should be no change, which can affect the quality of construction. The following are the test to be conducted before start of construction;



(a) On existing soil

- Classification test.
- Atterbergs limit
- Permeability test
- Density
- Moisture content

(b) Minerallic clay to be used for bottom and side liner system

- Permeability test "as compacted-then-saturated" samples: using flexible-wall permeability as per ASTM: D: 5084 or by using consolidation cell permeameter (Olson and Daniel (1979)).
- Density test as per IS: 2720 (part 28, 29, 34)
- Moisture content as per IS : 2720 (part-2)
- Grain size distribution as per IS 1498 and IS 2720 (Part 4 and 5)
- Strength parameters "as-compacted-then saturated" as per IS : 2720 (part 10, 11, 12)
- Atterberg's limit

(c) 1.5 mm thick HDPE Geo membrane:

Specifications

The Geo membrane is normally expected to meet the following requirements:

- It should be impervious
- It should have adequate strength to withstand sub grade deformations and construction loads
- It should have adequate durability and longevity to withstand environmental loads
- The joints/seams must perform as well as the original material.

Typical specifications for Geo membrane liners are given below.

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Table 1: Specification of HDPE Smooth Geo membrane

No.	Property	Test Method	Specified Values
1	Thickness, mm	ASTM D5199	≥ 1.5 mm
2	Density, g/cm ³	ASTM D 1505/D792	≥ 0.94 g/cc
3	Melt Flow Index, g/10 min	ASTM D 1238/D190/5	< 1 g/10 min
4	Tensile Strength at Yield, N/mm	ASTM D 638	≥ 23 kN/m
5	Tensile Strength at Break, N/mm	ASTM D 638	> 43 kN/m
6	Elongation at Yield, %	ASTM D 638	>13
7	Elongation at Break, %	ASTM D 638	> 700
8	Tear Resistance,	ASTM D 1004	≥ 150 N
9	Puncture Resistance, N	ASTM D 5494	≥ 250 N
10	Oxidative Induction time (OIT)	ASTM D 3895	100 min.
11	UV Resistance	-	Yes
12	ESCR, 100 hours	ASTM D 1693	Pass
13	Dimensional Stability after warm storage 1 hr/100 °C, %	ASTM D 1024	± 2%
14	Carbon Black Content %	ASTM D 1603 - 94	≥ 2%
15	Carbon Black Dispersion, Category	ASTM D 5596 – 94	Cat. 1 -2
16	Seam Strength (Shear)	ASTM D 4437	≥ 90% of parent material
17	Seam Strength (Peel)	ASTM D 4437, D413	≥ 60% of parent material
18	Roll Width, m	-	Min. 6 - 9 m
19	Chemical Resistance		Resistant to most strong acids and alkalis

The following components have to be designed / checked for in the case of Geo membrane:

- Anchor Trench
- Sliding Along Slopes
- Allowable Weight Of Vehicle
- Uneven Settlement
- Panel Layout Plan

Tests of several physical properties of the membrane must be performed before installation. Usually most of these tests are performed at the time of manufacturing in the manufacturer's laboratory. The owner may arrange for an independent observer to oversee the tests, conduct the



tests in an independent laboratory, or use a 'split sampling' technique. This issue of responsibility for pre-installation quality control tests must be clearly mentioned or resolved during the binding process.

(d) 150/500/1200 GSM Non-woven Geo textile liner:

Specifications:

The needle punched nonwoven Geo textile shall be used as protection layer above Geo membrane. The Geo textile shall be made of Polypropylene fiber manufactured through machine made process of heat bonding or needle punching techniques. The Average Roll Values of Geo textile shall be as shown in table 2.

Table 2 Properties of 150/500/1200 GSM Geo textile Liner:

Property	Test Method	Average Value For 150 GSM liner	Average Value For 500 GSM liner	Average Value For 1200 GSM liner
Mass per Unit Area, g/m ²	ASTM D 5261	150	500	1200
Thickness, mm	ASTM D 5199	1.20	3.20	6
Tensile Strength, kN/m	ASTM D 4595	9	36.0	55
Grab Tensile Strength, N	ASTM D 4632	525	1700	3600
Elongation Break, %	ASTM D 4595	50-95	50-75	70
CBR Puncture Resistance, N	ASTM D 6241	1100	5100	13000
AOS, Microns	ASTM D 4751	160	<75	<70
Permeability, Lit/m ² /sec	ASTM D 4491	230	30	3
Tear Strength, N	ASTM D 4533	190	700	2550
UV Resistance, %	ASTM D 4355	70	70	>50% strength retention
Roll Length, m		50	50	25
Roll Width, m		2/4/6	4/6	4/5

Note:

The values are average roll values in which all the properties are likely to have $\pm 10\%$ tolerances. Water Permeability, Elongations are likely to have -30% tolerance and Apparent Opening Size (AOS) have + 30%.

(e) **Sodium Bentonite based Geo synthetic Clay Liner:**

Sodium bentonite Based Geo synthetic Clay liner comprises of lower layer made from virgin quality Polypropylene Fiber Needle Punched Nonwoven Geo textile liner manufactured through machine made process of heat bonding or needle punching techniques and upper layer made from virgin quality Polypropylene Fiber Needle Punched Woven Geo textile liner with filling of Sodium Bentonite with a mass of 5 Kg/Sq.m. to allow the permeability of the liner to be reduced to the desired permeability required for landfill projects. It shall be sealed and packed from both ends with the existing layers and fused with weaving the liner. The over lapping between two GCL sheets shall be minimum 100 mm.

Maximum width of the film laid down singly shall not be less than 5 m. The liner so provided shall be tested at CIPET or government laboratory or other NABL approved laboratory for parameters specified as given in Table 3 below.

Table 3 Properties of 5 Kg/Sq.m. Sodium Bentonite based Geo synthetic Clay Liner:

Property	Test Method	Average Value
Geo textile Property		
Cap Non-Woven PP –Mass per Unit Area, g/m ²	EN ISO 9864	200
Carrier Woven PP –Mass per Unit Area, g/m ²	EN ISO 9864	125
Sodium Bentonite Properties		
Montmorillonite content, %	XRD Analysis	85
Swell Index, ml/2g	ASTM D 5890	25
Fluid Loss, ml	ASTM D 5891	17
Finished GCL Properties		
Bentonite mass per unit area @ 12% moisture content, Kg/Sq.m.	EN 14196	5
Bentonite mass per unit area @ 0% moisture content, Kg/Sq.m.	EN 14196	4.4
Hydraulic Conductivity, m/s	ASTM D 5887	2×10^{-11}
Index Flux, m ³ /m ² /s	ASTM D 5887	5×10^{-9}

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Tensile Strength - MD, kN/m	ASTM D 6768	12
Tensile Strength - CMD, kN/m	ASTM D 6768	12
Strain at Max. Load—MD, CMD, %	ASTM D 6768	≤30
Static Puncture Strength, KN	EN ISO 12236	2.2
Peel strength – MD, N/10cm	ASTM D 6496	65
Roll Length/Width, m		40/5
Thickness, mm	EN ISO – 9863 -1	6

(f) Biplanar Geo Net liner:

The item includes Providing and Laying of Biplanar Geo net made from HDPE material having thickness of 6.2 mm at 20kPa and Mass per Unit area of 720 GSM to be laid on Geo textile Liner on Side Slope to act as a base for laying Concrete on the geo textile liner.

Standard Specifications for Geo net:

The Geo nets covered in this specification are made from a formulation consisting of high density polyethylene (density>0.950g/cc), in a weight percentage of approximately 97%, with about 2% carbon black, and the remainder being antioxidants for protection during extrusion and long-term service performance.

Table 4: Geo net Properties:

Property	Unit	Test method	Value
Polymer	HDPE		
Thickness at 20kpa/200kpa	Mm	EN964	6.2/5.8
Thickness reduction due to creeping	%	EN1897	<3
Mass per unit area	Gm/m	EN965	720
Peak tensile strength, MD/CD	Kn/m	ISO10319	5.0/2.0
Elongation at break, MD/CD	%	ISO10319	20/90
Crushing Resistance	Kpa	ASTM D1621	>1.10

(g) Hard soil for sub base/soil bund

- Density
- Grain size distribution
- Atterbergs limit as per IS: 2720 (part-5)
- Strength parameters" as compacted -then- saturated" as per IS:2720 (PART 10,11,12)
- Compressibility parameters as per :IS2720 (part 15)
- Moisture content



(h) Surface Layer (Top Soil)

- Grain size distribution
- Plasticity
- Compaction test
- Shear strength

(i) Gravel/Coarse aggregates (for drainage layer)

The leachate collection layer or the drainage layer above the Geo membrane in the liner system must have a permeability of 10^{-2} cm/sec or more. Other specifications include the following:

- Shape of particles
- Grain size distribution
- Constant head Permeability $> 1 \times 10^{-2}$ cm /sec, as per IS 2720 (part 30,37)
- Insitu density test as per IS 2720 (part 14)
- Shear strength test as per IS 2720 (part 13)

(j) HDPE pipe (Leachate)

- M.F.I
- Density
- Wall Thickness
- C.B.C

(k) Other Civil Materials and relevant tests as per IS codes for civil construction:

Relevant tests like compressive strength, tensile strength and other such tests needed for civil work for different materials like bricks, RCC, PCC, steel etc. need to be carried out as per norms specified in IS codes during civil works.

1.2 Quality Assurance during the Preparation of the Clay Liner

1.2.1 Clay Liner Specification

The criteria for choosing clay is primarily based on the compacted permeability achievable under field conditions. The clay that can be compacted to obtain permeability (1×10^{-7} cm/sec or less) sample when compacted to 90-95% of the maximum Procter's dry density at optimum moisture content is chosen for landfill liner construction.

The selection of material to be used a soil barrier layer will usually be governed by the availability of materials as given in the specifications. The local soil does not have the adequate permeability



as per the specifications. Hence the foreign soil has to be imported or other available soil to be mixed other materials and amended. Properties of the same is listed below.

Usually a soil with the following specification would prove suitable for liner construction. In case of the absence of the clay of such properties, the **workable range** is also given.

- Liquid Limit > 30% (25-30)
- Plasticity Index > 15% (10-15)
- Plastic Limit > 10% (10-15)
- 50% fraction < 0.074 mm (40-50)
- Clay fraction > 25%. (18-25)

From the above, it is recommended that the permeability of the available soil could be achieved with addition of bentonite or other materials such as lime. The procedure for the same is described below.

1.2.2 Amended Soils (Compacted Clay)

In-situ available soil if of good quality or the one obtained from outside borrow pits may be mixed with medium to high plasticity imported clay, or commercial clays such as bentonite, to achieve the required low hydraulic conductivity. Soil bentonite admixtures are commonly used as low permeability amended soil liners. Requirement of bentonite to be mixed with local soil is to be ascertained in the soil testing laboratory for the specified tests and based on the results, appropriate % of bentonite shall be mixed with local soil to achieve the required standards.

The most commonly used bentonite admixture is sodium bentonite. It is not necessary that the bentonite should be the only additive to be considered for selection. Medium to high plasticity clays from not too distant areas, can also be imported and mixed with the local soils. Usually high quantities of clays (10 to 25 percent) are required to achieve the required permeability. Nevertheless, these may sometimes prove to be more economical than bentonite amended soils and their permeability may not be significantly influenced by leachate quality.

1.2.3 Specifications

A competent barrier made of compacted soils – clays or amended soils is normally expected to fulfill the following requirements:

- Hydraulic conductivity of 10^{-7} cm/sec or less;
- Thickness of 45 cm – 2 layers.



- Absence of shrinkage cracks due to desiccation
- Absence of clods in the compacted clay layer
- Adequate strength for stability of liner under compressive loads as well as alongside slopes; and
- Minimal influence of leachate on hydraulic conductivity.

Clays of high plasticity with very low values of permeability (usually well below the prescribed limit), exhibit extensive shrinkage on drying, as well as tend to form large clods during compaction in the relatively dry state. Their permeability can also increase on ingress of certain organic leachates. Well compacted inorganic clays of medium plasticity, either natural or amended, appear to be most suitable for liner construction.

1.2.4 Quality for the Raw materials

Before the preparation of clay liner the materials for mix shall be prepared as per the specification mentioned. The soil may be sieved and segregated separately based on their sizes, later on from the segregated material the aggregate shall be mixed in percentage as per the specification. The mixing should be in a mixing plant until it attains uniformity. The quantity of the prepared aggregate shall be 10 % more than what is required.

A sample of aggregate shall be taken for testing before it is used for preparation of desired clay. The testing shall be done by the contractor in presence of the AMC After the test results obtain from the above tests and finds suitable as per the specifications, then only the material has to be used for preparation of clay liner. The test results have to be documented. The test should be conducted for the soil is as under:

It is necessary to perform detailed laboratory tests and some field trial tests prior to liner construction to establish that the requirements pertaining to permeability, strength, leachate compatibility and shrinkage are met. All testing charges shall be borne by contractor.

1.2.5 Design Process

The design process for a compacted soil liner consists of the following steps:

1. Identification of borrow area or source of material – in-situ or nearby.
2. For in-situ soils, conducting field permeability tests to assess suitability of the natural soil in its in-situ condition.
3. Laboratory studies on liner material (from in-situ or nearby locations) comprising of the following tests:



- Soil classification tests
- Compaction tests
- Permeability tests
- Strength tests
- Shrinkages tests
- Leachate compatibility tests.

4. Identification of source of additive-natural clay from not too distant areas or commercially available clay such as bentonite.

5. Laboratory studies (as detailed in (2) above) on soil-additive mixes using different proportions of additive to find minimum additive content necessary to achieve the specified requirements.

6. Field trial on test pads; to finalize compaction parameters (layer thickness, number of passes, speed of compactor), as well as verify that field permeability of the compacted soil lies within pre-specified limits.

1.2.6 Test Reports

The evaluated results of the tests which are carried out during and after placement of clay are documented on paper by contracting firm. A note is made of the deviations, if any, from the desired values. The delivered batches of the mix are matched with the retained samples at the construction site, and the remarks are noted on the construction plan. The copy of test report should be submitted by the client for checking of the finished work. The report has to be preserved.

1.3 Quality Assurance during the Placement of Clay Liner into the Landfill

The special requirements of quality assurance in landfill sealing make it necessary that the personnel employed for operating the machines and for placement process should have adequate experience. A special type of equipment is required for the placement of clay on slopes. The placement of clay is carried out by using finishing machines or pavers which can ensure a uniform distribution and a good pre-compaction.

The following points has to be considered while placement of clay

- The sub grade with adequate load-bearing capacity is a prerequisite for the placement of clay. The foundation must be strong enough to permit the movements of the paving machine for the placement of clay without affecting the formation.



- The sub grade is true to slope profile, even and load-bearing. The subgrade should not deviate from the designed height by more than + 20 mm.
- The longitudinal and transverse gradients specified for the placement must not be affected while placement.
- The placement of clay layers must be carried out only in dry weather conditions.
- The total thickness of the clay after the compaction must be at equal to that of designed thickness.
- Any shortfall in the thickness should be compensated during the placement of the subsequent layer.
- It is necessary to ensure an adequate bounding of the lower layer of sealing layer with the base layer. If required, the surface of the base liner is evenly sprayed with binders.

1.3.1 Tests during and after placement of clay.

The following are the tests to be carried out during and after the placement of clay.

- Stability of subgrade before placing
- Layer thickness of clay after placement, before compaction.
- Layer thickness of clay after placement, after compaction.
- Permeability after compaction.
- Evenness
- Slope profile after compaction.

The above test results have to be recorded and documented for future reference.

1.4 Quality assurance planning during construction activity

During construction activity, arrangement for conducting the entire required tests at each stage of construction in time should be made. The tests to be conducted in the field as well as laboratory for different components of bottom, side and top liner is as follows:

a) During placement of clay liner

Total thickness = 90 cm (Placing in Four layers of not more than 23 cm each.) No. of tests and the type of tests to be carried out is indicated in Section – 20 below.

b) During placement of hard soil for Soil filling in Low lying Areas and Back filling of the soil over Non woven Geo textile liner on inner side slopes

Layer wise construction, thickness of each layer = 23 cm. No. of tests and the type of tests to be carried out is indicated in Section – 20 below.



d) During placement of HDPE Geo membrane and Geo textile.

- Check for thickness
- Check the joints

The quality control tests that are performed during installation include the following:

- Inspection of surface of compacted clay/amended soil layer.
- Verification of the proposed layout plan
- Check roll overlap
- Checking anchoring trench and sump
- Testing of all factory and field seams using proper techniques over full length.
- Destructive seam strength test
- Patch up repair

Geo membrane must be covered with protective layer of Geo textile or soil as soon as possible. Bare membrane should be guarded against such damage by fencing the area or by other appropriate methods.

The following procedure may be adopted:

- At least 500/1200 GSM Geo Textile should be spread on the membrane as a protective layer.
- The traffic routing plan must be carefully made so that the vehicle (s) does not travel on the membrane directly.

2.1 Documentation

All the quality assurance measures and tests carried out during construction must be documented by the contracting firm. A note is to be made in case of any deviations from the desired values. The copy of test report should be submitted to regulatory authorities. These reports have to be preserved for at least 20 years.

3.1 Checking

Regular checking shall be carried out after final closing of landfill facility. AMC shall assess, whether the finished liner system conforms to the specification stipulated in report. If any problem arises, it has to be rectified immediately.

**SECTION – 20****FREQUENCY AND TYPE OF TESTS TO BE CARRIED OUT UNDER QUALITY ASSURANCE PROGRAM FOR THE CONSTRUCTION OF SECURED LANDFILL PHASE:**

PLEASE NOTE: One set of tests is 3 samples per set which are taken from the same sample and all the samples are to be tested.

Sr. No.	Material	Type of test	Method	Frequency of tests to be done
1 A	On Soil surface from excavated borrow pits and piling of the soil to be used for amended clay liner	Grain size distribution/Classification test – 1 set of samples per 1000 cu.m. of excavated soil 1) Total soil requirement of Clay liner = 78498cu.m. 2) So no. of samples to be tested – 3 x 78498/1000 = 235.50~ 236 samples.	IS 1498 (part 4)	236
B		Atterberg limits – 1 set of sample per 1000 cu.m. of excavated soil as (1a) above	IS 2720 (part 5)	236
C		Water/Moisture Content – 1 set of sample per 1000 cu.m. of excavated soil as (1a) above	IS 2720 (part 2)	236
D		Standard Proctor and Modified Proctor Density (Light and Heavy Compaction) – One set of testof each type per 5000 cu.m. of excavated soil 1) Total soil requirement of Clay liner = 78498 2) So no. of samples to be tested – 3 x 78498/5000 = 47.10~ 47samples. Therefore, total no. of samples to be collected = 47 + 47 = 94 samples in which 47 samples for Standard Proctor Density and 47 samples for Modified Proctor Density.	IS 2720 (part 7 & 8) & IS 2720 (part 28/29/34)	94 (47 of each type)
E		Laboratory Permeability test – “As Compacted then Saturated Samples”- One Set of tests (3 samples per Set) per 5000 Cu.m. of excavated soil 1) Total soil requirement of Clay liner = 78498 2) So no. of samples to be tested – 3 x 78498/5000 = 47.10~ 47 samples.	ASTM: D – 5084 or Consolidation Cell Permeameter(Olson and Daniel, 1979)	47



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2 A	On Clay Material – Sodium Bentonite or Clayey Soils for each bentonite of clay sample procured	Grain Size Distribution/Classification test and Clay Content, Size – 50% fraction passing through <0.074 mm size sieve – 1 set of samples	IS 1498 (part 4 & 5)	3
B		Atterberg limits – Plastic/Liquid Limits/Plasticity Index	IS 2720 (part 5)	3
C		Permeability test – Permeability value to be achieved - less than 1×10^{-7} cm/sec	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and Daniel, 1979)	3
D		Standard and Modified Proctor Density	IS 2720 (part 28/29/34)	3
E		Moisture Content	IS 2720 (part 2)	3
F		Strength Parameters	IS 2720 (part 10, 11, 12)	3
G		Compressibility Parameters	IS 2720 (part 15)	3
3 A	For mixture of sodium bentonite and soil in Lab to fix up the % of bentonite to be mixed with soil	% of bentonite mixed with soil . Please repeat these tests for each different type of bentonite used for selecting bentonite. So the no. of samples shall vary with the no. of bentonite samples supplied to lab		3
B		Permeability of the mixture - Permeability value to be achieved - less than 1×10^{-7} cm/sec	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and Daniel, 1979)	3
C		Proctor Density	IS 2720 (part 28/29/34)	3



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D		Classification tests	IS 1498(part 4&5)	3
E		Atterberg limits	IS 2720 (part 5)	3
F		Moisture Content	IS 2720 (part 2)	3
G		Strength Parameters	IS 2720 (part 10,11,12)	3
H		Compressibility Parameters	IS 2720 (part 15)	3
4	Compacted Clay/Amended Clay Liner – Field Trial Test Pads of size 10m x 30m. No. of test pads to be constructed – 1.	Compacted Clay/Amended Clay Liner – Field Trial Test Pads of size 10m x 30m. No. of test pads to be constructed – 1. The thickness of the pad should be the same as the full-sized liner, to be constructed prior to the construction of the liner. Field permeability tests and quality control tests can be performed to obtain information regarding the range of values obtained in the field trials. Total Volume of compacted Clay/Amended Clay Liner of field trial test pad = 10 m x 30 m x 0.90 m thk. = 270 Cu.m.		
A		In Situ Density - 5 tests per 500 Sq.m. of each lift of 23 cm thickness compacted layer. Acceptable range of In Situ Density by Standard Proctor is > 95% of Maximum Dry Density and > 90% in Modified Proctor Density 1) Total Area of each lift of 23 cm thickness of the trial pad = 10 x 30 m = 300 Sq.m. 2) No. of test in each lift of 23 cm thickness of the trial pad = 300 x 5/500 = 3 samples. 3) Total no. of lifts in One layer of 90 cm compacted Clay liner = 4 4) So, no. of samples for total thickness of 90 cm of compacted Clay liner = 3 x 4 = 12 Samples.	IS:2720 (Parts 28/29/34)	12
B		In Situ Water/Moisture Content - 5 tests per 500 Sq.m. of each lift of 23 cm thickness compacted layer. Therefore, No. of samples for total thickness as above shall be 12 samples. Acceptable water contents may be typically in the range of optimum moisture content to 5 percent above optimum moisture content.	IS:2720 (Part 2)	12
C		Laboratory Permeability on "As-Compacted-Then-Saturated" Samples – One Set of tests (3 samples per set) for 2000 cu.m. of earth work. 1) Total Volume of Clay/Amended Clay Liner of field trial test pad = 10 m x 30 m x 0.90 m thk. (0.45 m each layer) = 270 Cu.m. 2) No. of samples to be taken = 270 x 3/2000 =	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and	1



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		0.40 ~ 1 sample. 3) To be on safer side, One sample on each 45 cm of compacted clay liner.	Daniel, 1979)	
5	Actual Compacted Amended Clay Liner – 90 cm total thickness	Amended Compacted Clay Liner –Total Volume of Compacted Amended Clay Liner of 90 cm thickness = 74394Cu.m. 90 cm thk. Layer will be constructed in 4 layers of 23 cm thk. Lifts. Area of 90 cm thk. clay liner = 82660Sq.m.		
A		In Situ Density - 5 tests per 500 Sq.m. of each lift of 23 cm thickness compacted layer. Acceptable range of In Situ Density by Standard Proctor is > 95% of Maximum Dry Density and> 90% in Modified Proctor Density 1) Total Area of each lift of 23 cm thickness of the actual clay liner = 89000 Sq.m. 2) No. of test samples in each lift of 23 cm thickness = $89000 \times 5/500 = 890$ samples. 3) Total no. of lifts in One layer of 90 cm compacted Clay liner = 4 4) So, no. of samples for total thickness of 90 cm of compacted Clay liner = $890 \times 4 = 3560$ Samples.	IS:2720 (Parts 28/29/34)	3560
B		In Situ Water/Moisture Content - 5 tests per 500 Sq.m. of each lift of 23 cm thickness compacted layer. Therefore, No. of samples for total thickness as above shall be 568 samples. Acceptable water contents may be typically in the range of optimum moisture content to 5 percent above optimum moisture content.	IS:2720 (Part 2)	3560
C		Laboratory Permeability on "As-Compacted-Then-Saturated" Samples – One Set of tests (3 samples per set) for 2000 cu.m. of earth work. 1) Total Volume of Amended Compacted Clay Liner = 80100 Cu.m. 2) No. of samples to be taken = $80100 \times 3/2000 = 120.15 \sim 120$ samples.	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and Daniel, 1979)	120
D		Grain Size distribution and Atterberg's limits of additive (bentonite) – One Set of tests for every 200 Cu.m. of additive. 1) Considering 2% bentonite requirement, volume of bentonite required = $80100 \times 0.02 = 1602$ cu.m.	IS 1498 (part 4 & 5)	24 samples for each test



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		2) So, no. of Grain size distribution tests = $1602 \times 3/200 = 24$ samples. 3) Similarly No. of Atterberg's limit of additive = 24 samples.		
E		Grain Size distribution and Atterberg's limits of soil + additive mixture – One set of test for every 1000 Cu.m. of mixed soil produced. Total Volume of Amended Compacted Clay Liner = 80100 Cu.m. 1) No. of samples to be taken = $80100 \times 3/1000 = 240$ samples.	IS 1498 (part 4 & 5)	240 samples for each test
F		Standard Proctor and Modified Proctor test – One Set of test of each type for every 2500 Cu.m. of mixed soil produced. Total Volume of Amended Compacted Clay Liner = 80100 Cu.m. 1) No. of samples to be taken = $80100 \times 3/2500 = 96$ samples. 2) So, 96 samples for Standard Proctor and 96 samples for Modified Proctor Density	IS 2720 (part 28/29/34)	96 samples for each type of Proctor test
G		Laboratory Permeability Test on As Compacted – Then – Saturated samples – One set of tests for every 2500 Cu.m. of mixed soil produced. Permeability value to be achieved - less than 1×10^{-7} cm/sec 1) So as above, no. of samples to be taken = 96 samples.	ASTM: D – 5084 or Consolidation Cell Permeameter (Olson and Daniel, 1979)	96
6	1.5 mm thk. HDPE membrane liner	1.5 mm thk. HDPE membrane - frequency of testing is one set per 5000 Sq.m or per lot (lot meaning consecutively numbered rolls from the same manufacturing line. In any case, the number of sets of samples should not be less than five for the landfill) 1) Total quantity of HDPE liner required = 89000 Sq.m. 2) No. of samples to be taken = $89000 \times 3/5000 = 53.4 \sim 53$ samples. 3) However, If per lot is calculated, then lot details shall be submitted by the contractor and accordingly no. of samples to be taken. 4) In any case, sample quantity shall not be less than 5. 5) Values of parameters shall be confirming to as indicated in Table 1 in Item wise specs. Of Liner works.		
		Thickness, mm	ASTM D5199	53 Or per lot
		Density, g/cm ³	ASTM	53 Or

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			D1505/D792	per lot
		Melt Flow Index, g/10 min	ASTM D1238/D190/5	53 Or per lot
		Tensile Strength at Yield, N/mm	ASTM D 638	53 Or per lot
		Tensile Strength at Break, N/mm	ASTM D 638	53 Or per lot
		Elongation at Yield, %	ASTM D 638	53 Or per lot
		Elongation at Break, %	ASTM D 638	53 Or per lot
		Tear Resistance, N	ASTM D 1004	53 Or per lot
		Puncture Resistance, N	ASTM D 4833	53 Or per lot
		ESCR, 100 hours	ASTM D 1693	53 Or per lot
		Dimensional Stability after warm storage 1 hr/100 °C, %	ASTM D 1024	53 Or per lot
		Oxidative Induction Time (OIT), min	ASTM D 3895	53 Or per lot
		Carbon Black Content %	ASTM D 1603 - 94	53 Or per lot
		Carbon Black Dispersion, Category	ASTM D 5596 – 94	53 Or per lot
		Chemical Resistance - Resistant to most strong acids and alkalis	-	53 Or per lot
		Seam Strength (Shear), Ave. Value - $\geq 90\%$ of parent material. One test every 150 m of length or for every no. of joint. 1) Average bottom longer side length = 373 m 2) Average bottom shorter side length = 97 m	ASTM D 4437	351

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		<p>3) Average width of HDPE liner = 7 m</p> <p>4) Average length of HDPE liner roll = 130 m</p> <p>5) So, No. of joints on longer length side on bottom = $373/130 = 3$</p> <p>6) No. of joints on shorter length side on bottom = $97/7 = 14$</p> <p>7) Hence no. of seam samples for liner on bottom = $3 + 14 = 17$</p> <p>8) No. of joints on Inner side slope from bottom to GL on 13.50 m depth slope:</p> <p style="padding-left: 40px;">n. Average length of inner side slope from bottom to GL on 13.50 m depth slope = 30.20 m</p> <p style="padding-left: 40px;">o. Average Periphery on this side = 80 m</p> <p style="padding-left: 40px;">p. So, No. of joints on slope length = $80/7 = 11.43 \sim 11$</p> <p>9) No. of joints on Inner side slope from bottom to GL on 17.90 m depth slope:</p> <p style="padding-left: 40px;">q. Average length of inner side slope from bottom to GL on 17.90 m depth slope = 40.02 m</p> <p style="padding-left: 40px;">r. Average Periphery on this side = 170 m</p> <p style="padding-left: 40px;">s. So, No. of joints on slope length = $170/7 = 24.28 \sim 24$</p> <p>10) No. of joints on Inner side slope from bottom to GL on 15.70 m depth slope:</p> <p style="padding-left: 40px;">t. Average length of inner side slope from bottom to GL on 15.70 m depth slope = 35.10 m</p> <p style="padding-left: 40px;">u. Average Periphery on One side of slope = 370 m</p> <p style="padding-left: 40px;">v. So, No. of joints on slope length = $370/7 = 52.85 \sim 53$</p> <p>11) No. of joints on Inner side slope from bottom to GL on 15.70 m depth slope (On other side):</p> <p style="padding-left: 40px;">w. Average length of inner side slope from bottom to GL on 15.70 m depth slope = 35.10 m</p> <p style="padding-left: 40px;">x. Average Periphery on other side = 499 m</p> <p style="padding-left: 40px;">y. So, No. of joints on slope length = $499/7 = 71.28 \sim 71$</p> <p>12) No. of joints on Inner side slope from GL to Earthen Bund Top on 6.00 m depth slope:</p> <p style="padding-left: 40px;">z. Average length of inner side slope from GL to Bund Top on 6.00 m depth slope = 13.42 m</p> <p style="padding-left: 40px;">aa. Average Periphery on first side =</p>		
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		<p>204.95 m</p> <p>bb. So, No. of joints on slope length = $204.95/7 = 29.27 \sim 29$</p> <p>13) No. of joints on Inner side slope from GL to Earthen Bund Top on 6.00 m depth slope:</p> <p>cc. Average length of inner side slope from GL to Bund Top on 6.00 m depth slope = 13.42 m</p> <p>dd. Average Periphery on second side = 421.82 m</p> <p>ee. So, No. of joints on slope length = $421.82/7 = 60.26 \sim 60$</p> <p>14) No. of joints on Inner side slope from GL to Earthen Bund Top on 6.00 m depth slope:</p> <p>ff. Average length of inner side slope from GL to Bund Top on 6.00 m depth slope = 13.42 m</p> <p>gg. Average Periphery on third side = 121.45 m</p> <p>hh. So, No. of joints on slope length = $121.45/7 = 17.35 \sim 17$</p> <p>15) No. of joints on Inner side slope from GL to Earthen Bund Top on 6.00 m depth slope:</p> <p>ii. Average length of inner side slope from GL to Bund Top on 6.00 m depth slope = 13.42 m</p> <p>jj. Average Periphery on fourth side = 481.09 m</p> <p>kk. So, No. of joints on slope length = $481.09/7 = 68.72 \sim 69$</p> <p>16) Hence total no. of seam samples for liner system on Inner Side Slope = $11 + 24 + 53 + 71 + 29 + 60 + 17 + 69 = 334$</p> <p>17) Hence total no. of seam and peel samples on bottom and inner side slopes = $17 + 334 = 351$</p>		
		Seam Strength (Peel) –Ave. Value - $\geq 60\%$ of parent material	ASTM D 4437, D413	351
7	Poly propylene Based Non wovenGeo textile Liner	For 150/500/1200 GSM Polypropylene based Non WovenGeo textile Liner - - frequency of testing is one set per lot for each grade (lot meaning consecutively numbered rolls from the same manufacturing line. In any case, the number of sets of samples should not be less than five for the landfill). Values shall be confirming to as indicated in Table 2 of Item wise specs. Of Liner works		
		Mass per Unit Area, g/m ²	ASTM D 5261	Per Lot or min. 5



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		Thickness, mm	ASTM D 5199	Per Lot or min. 5
		Tensile Strength, kN/m	ASTM D 4595	Per Lot or min. 5
		Grab Tensile Strength, N	ASTM D 4632	Per Lot or min. 5
		Elongation Break, %	ASTM D 4595	Per Lot or min. 5
		CBR Puncture Resistance, N	ASTM D 6241	Per Lot or min. 5
		AOS, Microns	ASTM D 4751	Per Lot or min. 5
		Permeability, Lit/m ² /sec	ASTM D 4491	Per Lot or min. 5
		Tear Strength, N	ASTM D 4533	Per Lot or min. 5
		UV Resistance, %	ASTM D 4355	Per Lot or min. 5
8	5 Kg/Sq.m. Sodium Bentonite based Geo synthetic Clay Liner	For Sodium Bentonite Based Geo synthetic Clay Liner- frequency of testing is one set per lot for each grade (lot meaning consecutively numbered rolls from the same manufacturing line. In any case, the number of sets of samples should not be less than five for the landfill). Values shall be confirming to as indicated in Table 3 of Item wise specs. Of Liner works		
		Geo textile Property		
		Cap Non-Woven PP –Mass per Unit Area, g/m ²	EN ISO 9864	Per Lot or min. 5
		Carrier Woven PP –Mass per Unit Area, g/m ²	EN ISO 9864	Per Lot or min. 5
		Sodium Bentonite Properties		
		Montmorillonite content, %	XRD Analysis	Per Lot or



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				min. 5
		Swell Index, ml/2g	ASTM D 5890	Per Lot or min. 5
		Fluid Loss, ml	ASTM D 5891	Per Lot or min. 5
		Finished GCL Properties		
		Bentonite mass per unit area @ 12% moisture content, Kg/Sq.m.	EN 14196	Per Lot or min. 5
		Bentonite mass per unit area @ 0% moisture content, Kg/Sq.m.	EN 14196	Per Lot or min. 5
		Hydraulic Conductivity, m/s	ASTM D 5887	Per Lot or min. 5
		Index Flux, m ³ /m ² /s	ASTM D 5887	Per Lot or min. 5
		Tensile Strength - MD, kN/m	ASTM D 6768	Per Lot or min. 5
		Tensile Strength - CMD, kN/m	ASTM D 6768	Per Lot or min. 5
		Strain at Max. Load—MD, CMD, %	ASTM D 6768	Per Lot or min. 5
		Static Puncture Strength, KN	EN ISO 12236	Per Lot or min. 5
		Peel strength – MD, N/10cm	ASTM D 6496	Per Lot or min. 5
		Thickness, mm	EN ISO – 9863 -1	Per Lot or min. 5
9	Biplanar Geo Net Liner on Geo Textile Liner on Inner Side Slopes	For Geo Net Liner- frequency of testing is one set per lot for each grade (lot meaning consecutively numbered rolls from the same manufacturing line. In any case, the number of sets of samples should not be less than five for the landfill). Values shall be confirming to as indicated in Table 4 of Item wise		



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		specs. Of Liner works		
		Thickness at 20 KPa/200 KPa, mm	EN 964	Per Lot or min. 5
		Thickness reduction due to creeping, %	EN 1897	Per Lot or min. 5
		Mass per unit area, Gm/Sq m	EN 965	Per Lot or min. 5
		Peak tensile strength md/cd, KN/m	ISO 10319	Per Lot or min. 5
		Elongation at break md/cd, %	ISO 10319	Per Lot or min. 5
		Crushing Resistance, KPa	ASTM D 1621	Per Lot or min. 5
10	Leachate Collection System – Coarse Sand and Drainage layer consisting of 10 – 20 mm and 6 – 10 mm size gravels/aggregates	Shape of particles - One set of tests per 1000 cu.m of drainage layer material recd. 1) Total Volume of drainage layer = $2304 \times 3 = 6912 \text{ Cu.m.}$ 2) No. of samples to be taken = $6912 \times 3/1000 = 20.74 \sim 20$ samples.	By view	20
B		Grain size distribution - One set of tests per 1000 Cu.m of compacted drainage layer	IS:2720 (Part 4)	20
C		Constant head permeability - One set of tests per 2000 Cu.m. of compacted drainage layer. = $6912 \times 3/2000 = 10.37 \sim 10$ samples	IS 2720 (part 30,37)	10
D		In situ density: One set of tests per 1000 cu.m.	IS 2720 (part 28 & 33)	20
11	HDPE pipes – Leachate Collection Pipes	MFI, 1 set for 160/315/400 mm dia HDPE pipe	IS 4984:1995	3
		Density, 1 set for 160/315/400 mm dia HDPE pipe	IS 4984:1995	3
		Wall Thickness, 1 set for 160/315/400 mm dia HDPE pipe	IS 4984:1995	3



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		CBC, 1 set for 160/315/400 mm dia HDPE pipe	IS 4984:1995	3
12	Hard Soil for construction of earthen bund, and for back filling of soil in low lying areas of inner side slopes in deep crevices	Grain Size Distribution - One Set of tests - 3 samples every 1000 Cu.m. of earthwork– compacted/watered/rolled 1) Volume of soil used in earth filling in construction of earthen bund – 129110cu.m. 2) Volume of soil used for backfilling in low lying areas of inner side slopes in deep crevices – 42080cu.m. 3) Therefore, Total Volume of soil used for all these works – 1,71,190 cu.m. 4) So no. of samples to be tested – $3 \times 171190/1000 = 513.57$ samples ~ 514 samples.	IS 1498 (part 4 & 5)	514
b		Atterberg limits - 3 sample per 1000 cu.m. of excavated soil as (11a) above	IS 2720 (part 5)	514
c		Compressibility parameters - 3 sample per 1000 cu.m. of excavated soil as (11a) above	IS 2720 (part 15)	514
d		Moisture Content- 3 sample per 1000 cu.m. of excavated soil as (11a) above	IS 2720 (part 2)	514
e		Strength Parameters “as compacted then saturated” - 3 sample per 1000 cu.m. of excavated soil as (11a) above	IS 2720 (part 10,11,12)	514
f		Field Dry Density and Maximum Dry Density- Standard Proctor Test - >95% Std. Proctor density on horizontal compacted surface and >90% on side slopes - 3 sample per 1000 cu.m. of excavated soil as (11a) above	IS 2720 (part 28/29/34)	514

Additional General Construction materials tests and their frequency:

Sr. No.	Material	Type of test	Method	Frequency of tests to be done
13	Water used for Construction	As per IS – 456: <ul style="list-style-type: none"> pH Value Limits of Acidity Limits of Alkalinity Percentage of Solids Chlorides Suspended matter Sulphates Inorganic Solids Organic Solids 	IS – 3025/APHA	Water from each source shall be got tested before the commencement of work and thereafter once in every three months till the completion of the work. Water from municipal source need be tested only once in six months. Number of Tests for each source shall be 3



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14	Cement	a) Physical Requirement i) Fineness ii) Soundness iii) Setting Time (initial and final) iv) Compressive Strength v) Consistency of standard cement paste	IS – 4031 Part (II) Part (III) Part (V) Part (VI) Part (VI)	Every 50 tons or part thereof. Each brand of cement brought to site shall be tested as per this frequency. Total Cement Consumption = 6577.69 MT, so no. of cement samples to be analysed = 132 samples
15	Rubble – Basalt (Deccan trap)	i) Specific gravity ii) Compressive Strength iii) Shear strength iv) Tensile strength v) Porosity vi) Resistance to abrasion vii) Modulus of Elasticity	IS – 1123: 1975	1 set of sample every 1000 cu.m. Total rubble consumption in all works = 6600 Cu.m. So no. of samples to be analysed = 6.6 ~ 7 samples
16	Coarse and Fine Aggregates used for PCC & RCC work	i) Percentage of soft or deleterious material ii) Particle size iii) Estimation of organic Impurities iv) Surface Moisture v) Determination of 10% fine value vi) Specific gravity vii) Bulk density viii) Aggregate crushing Strength ix) Aggregate impact value	IS 2386	1 set of sample every 50 Cu.m. 1) Total Volume of Coarse aggregates consumed in all works = 10908 Cu.m. So no. of samples to be analysed = 218 samples 2) Total Volume of fine aggregates consumed in all works = 5447.48 Cu.m. So no. of samples to be analysed = 108.95 samples ~ 109 samples.
17	PCC (1:4:8)	i) Minimum Compressive strength of 150 mm cube after 28 days shall be 7.5 N/mm ² ii) Total Quantity of Dry Aggregates by Mass per 50 kg of cement, to be taken as the Sum of the Individual Masses of Fine and Coarse Aggregates, Kg. Max – 625 kg	IS – 456	1 set of sample every 50 Cu.m. Total PCC (1:4:8) work = 3423 Cu.m. So, no. of samples to be analysed = 3423/50 = 68.46 samples ~ 68 samples



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		<p>iii) Proportion of Fine Aggregate to Coarse Aggregate (by Mass) - Generally 1:2 but subject to an upper limit of 1: 1 ½ and a lower limit of 1:2 ½</p> <p>iv) Quantity of Water per 50 kg of Cement, max Ltr. – 45 Ltrs.</p>		
18	RCC M 20, M 25& M30	<p>i) Minimum Compressive strength of 150 mm cube after 28 days shall be 20 N/mm² for M20 grade concrete and 25 N/mm² for M25 grade concrete and 30 N/mm² for M30 grade concrete</p>	IS – 456	<p>4 set of samples upto 50 Cu.m. Then 1 sample additional every 50 Cu.m. in addition to 4 samples above.</p> <p>a) Total no.of samples for RCCM20 work = 2019/50 = 40 + 5 = 45 samples.</p> <p>b) Total no. of samples for RCC M25 work = 257/50 = 5 +5 = 10 samples.</p> <p>c) Total no. of samples for RCC M30 work = 9524/50 = 190 +5 = 195 samples.</p>
19	Reinforcement Steel - Fe 500 grade TMT bars	<p>i) 0.2 Per cent Proof stress/ yield stress, Min, N/mm² – 500 N/mm²</p> <p>ii) Elongation, per cent, Min. on gauge length 5.65 Sq.root of A , where A is the cross-sectional area of the test piece. – 16.0 %</p> <p>iii) Tensile strength, Min - 10 Per cent more than the actual 0.2 per cent proof stress/yield stress but not less than 565.0 N/mm²</p> <p>iv) Total elongation at maximum force, percent, Min on gauge length 5.65 Sq.root of A , where A is the cross-sectional area of the test piece. – 5%</p>	IS – 432 Part I & II & IS - 1786	<p>1 set of sample every 45 MT. Total Reinforcement Steel consumption in all works =602.845MT. So, no. of samples to be analyzed = 13.39 samples ~ 13 samples</p>



Notes:

- 1) Total RCC M30 work – 10393Cu.m.
- 2) Min. Cement consumption in RCCM30 grade with 20 mm aggregates – 475 Kg/cu.m. (as per IS 456,2000), so Cement consumption – 4936675 Kg = 4936.68 MT = 98734 bags
- 3) Total RCC M25 work – 257 Cu.m.
- 4) Min. Cement consumption in RCCM25 grade with 20 mm aggregates – 450 Kg/cu.m. (as per IS456, 2000), so Cement consumption – 115650 Kg = 115.65 MT = 2313 bags
- 5) Total RCC M20 work – 2019Cu.m.
- 6) Min. Cement consumption in RCCM20 grade with 20 mm aggregates – 320 Kg/cu.m. (as per IS:456 -2000 – severe conditions), so Cement consumption – 646080Kg = 646.08 MT = 12921.60 bags
- 7) Total PCC work (1:4:8) grade – 3423Cu.m.
- 8) Min. Cement consumption in PCC grade with 20 mm aggregates – 250 Kg/cu.m. (as per IS:456 -2000 – severe conditions), so Cement consumption – 855750 Kg = 855.75MT = 17115 bags
- 9) Total Plaster works in CM (1:4) = 3072Sq.m. = 61.44 Cu.m. (20 mm thk.). Dry volume of plaster = $1.33 \times 61.44 = 81.71\text{Cu.m.}$
- 10) Cement consumption in plaster works = $0.20 \times 81.71 = 16.34\text{cu.m.} \times 1440 \text{ kg/cu.m.} = 23533.98 \text{ kg} = 23.534 \text{ MT} = 470.68 \text{ bags.}$
- 11) Thus Total Cement Consumption = $4936.68 + 115.65 + 646.08 + 855.75 + 23.534 = 6577.69 \text{ MT.}$
- 12) Total Steel work – 602845 Kg = 602.845MT including 8 mm, 10 mm, 12mm, 16 mm, 20 mm & 25 mmdia bars
- 13) Total Rubble Soling Work = 6600Cu.m.
- 14) Total Aggregate consumption:
 - a) In PCC (1:4:8) work = 625 kg/50 kg of cement = $625/50 \times 855750 = 10696875 \text{ Kg}$, of which Fine aggregates (sand) = $1/3 \times 10696875 = 3565625 \text{ Kg}$ and 20 mm Coarse Aggregates = $2/3 \times 10696875 = 7131250 \text{ Kg}$. So, Volume of fine aggregate (sand) = $3565625/1600 = 2228.515\text{Cu.m.}$ considering a bulk density of 1600 Kg/cu.m. and Volume of coarse aggregate = $7131250/1550 = 4600.806\text{Cu.m.}$ considering a bulk density of 1550 Kg/cu.m for coarse aggregates.



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- b) In RCC M20, Volume of RCCM20 = 2019Cu.m. Now Volume of fine aggregates (sand) needed = 0.428 Cu.m per Cu.m. of RCCM20 and Volume of Coarse aggregates (20mm aggregates) needed = 0.856 Cu.m. per Cu.m. of RCC M20. Therefore Quantity of fine aggregates needed for RCCM20 work = $0.428 \times 2019 = 864.132\text{Cu.m.}$ and quantity of coarse aggregates needed for RCC M20 work = $0.856 \times 2019 = 1728.264\text{Cu.m.}$
- c) In RCC M25, Volume of RCC M25 = 257Cu.m. Now Volume of fine aggregates (sand) needed = 0.385 Cu.m per Cu.m. of RCCM25 and Volume of Coarse aggregates (20mm aggregates) needed = 0.77 Cu.m. per Cu.m. of RCC M25. Therefore Quantity of fine aggregates needed for RCCM25 work = $0.385 \times 257 = 98.945\text{Cu.m.}$ and quantity of coarse aggregates needed for RCC M25 work = $0.77 \times 257 = 197.89\text{Cu.m.}$
- d) In RCC M30, Volume of RCC M30 = 10393 Cu.m. Now Volume of fine aggregates (sand) needed = 0.230Cu.m per Cu.m. of RCCM30 and Volume of Coarse aggregates (20mm aggregates) needed = 0.46Cu.m. per Cu.m. of RCC M30. Therefore Quantity of fine aggregates needed for RCCM30 work = $0.23 \times 10393 = 2390.39 \text{ Cu.m.}$ and quantity of coarse aggregates needed for RCC M30 work = $0.46 \times 10393 = 4780.78 \text{ Cu.m.}$
- e) In Cement Plaster CM (1:4), Volume of Plaster = 81.71Cu.m. Volume of fine aggregates (sand) used = $0.80 \times 81.71 = 65.368\text{Cu.m.}$
- f) No. of bricks in 1 Cu.m. of brickwork including mortar = 425 bricks. Now volume of brick masonry = 292 Cu.m. So, no. of bricks to be used = $425 \times 292 = 124100 \text{ No.}$
- g) Thus Total Volume of fine aggregates consumed in all the works including PCC and all grades of RCC and in plaster = $2228.515 + 864.132 + 98.945 + 2390.39 + 65.368 = 5647.35 \text{ Cu.m.}$ and Total Volume of Coarse aggregates consumed in all the works including PCC and all grades of RCC = $4600.806 + 1728.264 + 197.89 + 4780.78 = 11307.74 \text{ Cu.m.}$



SECTION – 21

PROFORMA OF CONTRACT AGREEMENT

Articles of agreement made this _____ day of the month of _____ 2026 Between M/s. _____ hereinafter called the “BIDDER” (which expression shall include their administrator, successors and permitted assignees) of the One part and the ADDITIONAL CITY ENGINEER, SOLID WASTE MANAGEMENT DEPARTMENT, AMC on behalf of The MUNICIPAL COMMISSIONER of “AHMEDABAD MUNICIPAL CORPORATION” (which expression shall include his successors and permitted assignees) of the Other part for the work of **CONSTRUCTION OF SECURED LANDFILL PHASE 2 OF AHMEDABAD MUNICIPAL CORPORATION AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD, TALUKA & DISTRICT – AHMEDABAD, GUJARAT, INDIA**; and,

Whereas the Bidders above named tendered for the works above mentioned and the same having been accepted by the management of the AHMEDABAD MUNICIPAL CORPORATION vide Resolution No. _____ dated _____; it is hereby agreed that the Bidder should carry out the works according to the terms and conditions of the contract detailed in the Item Rate Tender Books, - conditions and specifications, which have been signed by the bidders on,

And, Whereas

A) The AMC being desirous of having provided and executed certain works mentioned, enumerated or referred to in the tender documents including Short Tender Notice, General Tender Notice, General Conditions of Contract, Important Conditions of Contract. Specifications, Drawings, Plants, Time Schedule of Completion or Jobs, Agreed Variations other documents has called for Tender.

B) The bidder has inspected the site and surroundings of the works specified in the tender documents and has satisfied himself by careful examination before submitting has tender as to the nature of the surface strata, sub-soil and ground, live form and nature of site and local conditions, the quantities, nature and magnitude of the work the availability of labor and materials necessary for the execution of work, the means of site, the supply of power and water thereto and the accommodation he may require and has made local and independent inquiries and obtained complete information as the matters and things and referred to or implied in the tender document or having any connection therewith, and has considered the nature and extent of all probable and possible situations hindrances or interference's to or with the execution and completion of the work to be carried out under the Contract and has examined and considered all other matters, condition and things and possible, and general all matters incidental thereto and ancillary thereof affecting the execution and completion of the work and which might have influenced him in making his tender.

C) The notice inviting tender, general conditions of contract, important conditions of contract, general obligations, specifications, drawings, plans, time schedule of completion of jobs, letter of acceptance of tender and any statement of agreed variation with its enclosures,



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copies of which are also hereto annexed, form part of this contract though separately set out herein and are included in the expression "CONTRACT" wherever herein used.

And Whereas

The AMC accepted the tender of the bidder for the provision and the execution of the said work at the rates stated in the Schedule of quantities of works and finally approved by AMC (here in after called the "Schedule of Rates") upon the terms and subject to the conditions of contract,

Now This Agreement Witnesseth and it is hereby agreed and declared as follows:-

In consideration of the payment to be made to the bidder for the work to be executed by him, the bidder hereby make covenant with the AMC that the bidder shall and will duly provide, execute and complete the said works and shall do and perform all other acts and things in the contract mentioned or described or which are to be implied there from or may be reasonably necessary for the completion of the said works and at the said times and in the manner and subject to the terms and conditions or stipulations mentioned in the contract.

In consideration of the due provision execution and completion of the said works, the AMC does hereby agree with the Bidder that the AMC will pay to the bidder the respective amounts for the work actually done by him and approved by the AMC at the Schedule of Rates and such other sum payable to the bidder under provision of Contract, such payment to be made at such time in such manner as provided for in the Contract.

AND

In consideration of the due provision, execution and completion of the said works the bidder does hereby agree to pay such Sums as may be due to the AMC for the services rendered by the AMC to the Bidder, such as power supply water supply and others as set for in the said contract and such other sum as may become payable to the AMC towards the controlled items of consumable materials or towards loss damage to the AMC 's equipment, materials construction plant and machinery, such payments to be made at such time and in such manner as is provided in the Contract.

It is specifically, and distinctly understood and agreed between the AMC and the Bidder that the bidder shall have no aright, title or interest in the site made available by the AMC for execution of the works or in the building, structures or works executed on the said site by the bidder or in the goods articles, materials etc. brought on the said site (unless the same specifically belongs to the bidder) and the bidder shall not have or deemed to have any lien whatsoever charge for unpaid bills nor will be entitled to assume or retain possession or control of the site or structures and the AMC shall have an absolute and unfettered right to take full possession of site and to remove the bidder, their servants, agents and materials belonging to the bidder and lying on the site.

The bidder shall be allowed to enter upon the site for execution of the works only as a license simplicitor and shall not have any claim, right, title or interest in the site or the structures erected



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thereon and the AMC shall be entitled to terminate such license at any time without assigning any reason.

The materials including sand, gravel, stone, loose earth, rock etc. dug up or excavated from the said site shall, unless otherwise expressly agreed under this contract exclusively belong to the AMC and the bidder shall have no right to claim over the same and such excavations and materials should be disposed of on-account of the AMC according to the instructions given by AMC.

In witness whereof the said Bidder and the ADDITIONAL CITY ENGINEER, SOLID WASTE MANAGEMENT DEPARTMENT, AMC on behalf of The MUNICIPAL COMMISSIONER, AHMEDABAD MUNICIPAL CORPORATION have hereinto set their respective hands this _____ day of the month of _____ of the year 2026.

Signed, sealed and delivered by the said bidder in the presence of

1. _____

2. _____

Signature and Stamp of Bidder,

**Additional City Engineer, Solid Waste Management
Department, Ahmedabad Municipal Corporation**

I am responsible if the Bidder does not abide by the Condition of this contract.

Sealed with the common seal of the AHMEDABAD MUNICIPAL CORPORATION in the presence of ---

1. _____

2. _____

**Additional City Engineer, Solid Waste Management
Department, Ahmedabad Municipal Corporation**



SECTION-22

GENERAL INFORMATION OF THE BIDDER

As per General Conditions of Contract, General Instructions to Bidders - All individual firms are requested to complete the information in this form. Individual information should be provided for all owners or Bidders that are partnerships or individually owned firms.

A. In case of Individual Firm/Proprietorship

1) Name and address of Business with contact numbers, fax nos., e-mail:

2) Whether his business is registered:

a) GST Registration No./TIN No.:

b) Provident Fund Registration No.:

c) Government Approved Bidder Registration Class:

3) Date of commencement of business:

4) Whether he pays Income Tax over Rs. 10,000/-per year. Please furnish details for the last THREE years, with corresponding Income Tax Certificate and CA Certificate showing the Turn Over as mentioned earlier:

B. In case of partnership firm

i) Name and address of partnership firm with contact numbers, fax no., e-mail:

ii) Name and address of each partner with contact numbers, fax nos., e-mail, recent passport size photographs of each partner with their specimen signatures:

iii) Whether the partnership is registered and copy of the partnership deed

iv) Date of establishment of firm



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- v) Certified Copy of the deed of partnership firm
- vi) Attach complete organizational chart of the firm
- vii) In case of Government royalty applicable to the Bidder, it is compulsory to submit a receipt of royalty payment with tender.
- viii) In case of Octroi applicable to the goods of supplier/Bidder, the Bidder/supplier has to submit the attached copy of all octroi receipts.
- ix) If each of the partners of the firm pays income tax, over Rs. 10000/- a year and if not which of them pays the same. Furnish details for the last THREE years.

C. In case of Limited Liability Partnership or Private Limited Company or Limited Company by Guarantees:-

- i) Amount of paid up capital
- ii) Names and address of Directors
- iii) Certificate of incorporation of Bidding Company
- iv) Copies of the last THREE years balance sheets of the Bidding Company
- v) Copy of Memorandum and of Articles of Association of the Bidding Company
- vi) Certified true copy of Board resolution authorizing to undertake the work related to this project

Signature and Stamp of Bidder

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SECTION - 23**FINANCIAL DETAILS OF THE BIDDER****(LAST THREE YEARS)****(Attach copies of the audited financial statements of the last three financial years)**

SR.NO.	ITEM DESCRIPTION	AMOUNT IN RS.
1	Share Capital	
2	Reserves	
3	Total Working Capital	
4	Annual Turnover	
5	Value of works on hand	
6	Proposed Funds to be diverted for this work	
Remarks:		

ATTACHMENTS:

- 1) GST Certificate with proof of residence
- 2) PAN No. and TIN No.
- 3) Income Tax Returns of last three financial years
- 4) Solvency Certificate
- 5) Labor Insurance and Labor PF Account No.
- 6) Bank Guarantee
- 7) Work Contract Tax No.
- 8) "C" certificate no.

Signature and Stamp of Bidder



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SECTION - 24

DETAILS OF EXPERIENCE/PROJECTS OF THE BIDDER

Bidder shall give information of similar works done during last Ten years strictly as per the proforma given below. This shall be submitted in quadruplicate. **Attach copies of the audited financial statements of the last three Years**

Sr. No	Full particulars of similar work carried out by Bidder	Value of Contract	Completion time as stated in Tender in months	Actual Completion time in months	Year of completion	Name and postal address of the client

Note: Attach details in separate sheet if needed.

Certified that the above information is correct.

Signature and Stamp of the Bidder

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Bidder shall give information of the equipment possessed/Manpower available or propose to bring on rental basis strictly as per the proforma given below.

A) List of Equipment/Plants/Tools with the Bidder:

Sr. No	Description of the equipment	No. of such equipment	Make of Equipment	Capacity	Owned or rented	Approx. date when it will be deployed at site	Period of retention on site

B) List of Manpower Available with the Bidder:

Submit list of technical and non-technical manpower with names, qualification and other details to be deployed on site and HQ for the project. (Do not include labor)

Sr. No.	Name of person	Project Designation	Company designation



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Note:

- 1 Please attach CV of technical persons and Safety personnel.

Attach Manning (Personal) schedule stating each personnel's roles and responsibility for work to be carried out for the Project.

Note: Attach details in separate sheet if needed. Certified that the above information is correct.

Signature and Stamp of the Bidder



SECTION - 26

HISTORY OF LITIGATION OF THE BIDDER, UNDERTAKING, DECLARATION AND AFFIDAVIT BY THE BIDDER

1. History of Litigation of the Bidder:

Bidder should provide information on any history of litigation or arbitration resulting from contracts in last five years or currently under execution.

Year	Award for / or Against Bidder	Name of Client, cause of Litigation and matter of dispute	Disputed amount in Rupees

Note:

If the information to be furnished in this schedule is not given and come to the knowledge of AMC subsequently it will result in disqualification of the bidder.

2. Undertaking By the Bidder:

Photographs of Partners, Managing Director



1. I/We agree that the decision of the Ahmedabad Municipal Corporation in pre-qualification/selection of Bidders/Bidder, Phasing of work and in any other project related matter, will be final and binding the me/us.

2. All the information and data furnished herewith and correct to my/our best of knowledge.



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3. I/We agree that we have no objection if inquiries are made about our works, its related areas and any other inquiry regarding all details, projects and works listed by us in the pre-qualification document at any state.

Signature of Bidder with seal of the company

3. AFFIDAVIT BY THE BIDDER * ON Rs. 300 Stamp paper:

1. I, the undersigned, do hereby certify that all the statements made in the required attachments are true and correct.

2. The undersigned also hereby certifies that neither our firm M/s. _____ nor any of its constituent partners have abandoned any work in India nor any contract awarded to us for such works have been rescinded, during last TEN years prior to the date of this application.

3. The undersigned hereby authorize(s) and request(s) any bank, person, firm or corporation to furnish pertinent information deemed necessary and requested by the Department to verify this statement or regarding my (our) competence and general reputation.

4. The undersigned understands and agrees that further qualifying information as may at the request, of the Ahmedabad Municipal Corporation.

Signed by an Authorized Officer of the Firm

Title of Officer

Name of Firm

Date

Affidavit shall be given on Non-judicial stamp paper of value worth Rs.300/- duly signed by authorized notary



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SECTION - 27

PROPOSED SCHEDULE OF THE BIDDER

BIDDERS PROPOSED COMPLETION SCHEDULE IN THE FORM OF BAR/PERT/CPM CHART OF ANY OTHER METHOD AS APPROVED BY THE AMC

SIGNATURE AND STAMP OF THE BIDDER:

NAME AND ADDRESS:

DATE:



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SECTION - 28

PROFORMA FOR BANK GUARANTEE

To,

Dear Sirs,

WHEREAS _____ a Company Incorporated under the Companies Act, 1956 and having its Registered Office at _____ (hereinafter referred to as the Bidder, which expression shall include its successors and permitted assigns) has, in terms of Work Order No. _____ Dated _____ issued by you to the said Bidder and accepted by the said Bidder, contracted to execute the work of the **CONSTRUCTION OF PHASE 2 OF SECURED ENGINEERED MUNICIPAL SOLID WASTE LANDFILL SITE FOR DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTES AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD, TALUKA & DIST. AHMEDABAD** as stated in the said Work Order.

AND WHEREAS it is provided in the said Work order that you may retain with you a sum Rs. _____ (RUPEES _____ ONLY) towards defects in the Construction of Infrastructure Facilities by the bidder or in construction thereof till the expiry of the Defects Liability period as provided in the said Work Order, but that the Bidder shall have option to furnish a Bank Guarantee in your favor in lieu of such retention money.

AND WHEREAS the Bidder has requested us to issue in your favor the Bank guarantee as aforesaid. NOW, we _____ (name of the Bank) _____ hereby irrevocably agree and undertake as follows :

1. That the said Bidder shall duly and faithfully carry out its obligation under the said Work Order to your satisfaction, Failing which we hereby irrevocably guarantee to pay to you without reference to the bidder and without any demur, merely on demand from you stating that the amount claimed is due by way of loss or damage caused to or that may be caused to or suffered by the Corporation by reason of the breach by the Bidder of any of the terms and conditions in the said Work Order. Any such demand made on us shall be conclusive as regards the amount due and payable to you under this Guarantee.

However our liability under this guarantee shall be restricted to an amount not exceeding Rs. _____ (being the amount of the Bank Guarantee in lieu of Retention Money contemplated by the aforesaid Purchase order).

This guarantee shall remain in full force and effect for a period of 12 months from the date of Virtual Completion of Civil Work provided always that the guarantee shall be valid for a period of at least 6 months from the date, the Bidder rectifies any defective work or repairs the same.



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We, lastly undertake not to revoke this guarantee during its currency except with your previous consent in writing. Notwithstanding anything contained herein above our liability under this guarantee is restricted to Rs. _____(RUPEES _____ONLY).

This guarantee shall remain valid for the period provided for in Clause above. Unless a claim in writing is lodged with us within a period of 3 months from the date of expiry of the guarantee, all your rights under this guarantee shall be forfeited and we shall be released and discharged from all liabilities under this guarantee.



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SECTION – 29

LIST OF NATIONALIZED/SCHEDULED BANKS

ANNEXURE-1

A) Guarantee issued from the following banks shall be accepted as SD/EMD on permanent basis:

- **All Nationalized Banks**

B) Guarantees issued by following banks will be accepted as SD/EMD for the period up to March 31, 2026. The Validity Cut off Date in the GR is with respect to the date of issue of Bank Guarantee irrespective of the date of termination of Bank Guarantee.

1) Commercial Banks:

1. Axis Bank
2. AU Small Finance Bank
3. Bandhan Bank
4. Barclays Bank
5. City Union Bank
6. CSB Bank
7. DBS Bank India Limited
8. DCB Bank
9. Equitas Small Finance Bank
10. ESAF Small Finance Bank
11. Federal Bank
12. HDFC Bank
13. HSBC Bank
14. ICICI Bank
15. IDBI Bank
16. IDFC First Bank
17. Jammu And Kashmir Bank
18. Jana Small Finance Bank
19. Karnataka Bank
20. Krur Vysya Bank
21. Kotak Mahindra Bank
22. South Indian Bank
23. Standard Chartered Bank
24. Tamilnadu Mercantile Bank
25. Utkarsh Small Finance Bank
26. Yes Bank



2) Co-operative and Rural Banks of Gujarat

1. The Ahmedabad Mercantile Co-operative Bank Limited
2. Nutan nagrik Sahakari Bank Limited
3. Rajkot Nagarik Sahakari Bank Limited
4. Saraswat Co-operative Bank
5. SBPP Co-operative Bank
6. SVC Co-operative Bank LTD.
7. The Cosmos Co-operative Bank
8. The Gujarat State Co-Operative Bank
9. The Mehsana Urban Co-operative Bank Limited
10. The Surat District Co-operative Bank
11. The Surat Peoples Co-operative Bank
12. The Kalupur Commerical Co-operative Bank Limited
13. The Panchmahal District Co-operative Bank
14. The Baroda District Co-operative Bank
15. Baroda Gujarat Gramin Bank
16. Saurashtra Gramin Bank

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SECTION – 30**TECHNICAL DETAILS OF LANDFILL PHASE 2**

NO	ITEM DESCRIPTION	QUANTITY
1	Estimated Quantum of Waste to be landfilled	500 MT/Day = 180000 MT/Year with basis of 360 working days.
2	Average Size of the Phase Constructed and Configuration of the phase	462 m x 174 m x 21.7 m (D) in slope of 1:2.0(V:H) from Top of Earthen Bund to bottom of Landfill+ 15 m height of waste in heap form in a slope of 1:4 above the top of the wall – Landfill Phase is combination of Below and Above Ground Landfill
3	Area and Perimeter of the Phase at EGL	A = 60380 Sq.m., P = 1178 m
4	Bottom Area and Perimeter of the Phase	A = 23035Sq.m., P = 869 m
5	Top Area and Perimeter of the Earthen Bund	A = 75308 Sq.m. P = 1278 m
6	Average Area of the Phase	49172Sq.m.
7	Depth from EGL to Bottom of Phase at Exit Ramp side	17.90 m
8	Depth from EGL to Bottom on opposite of Exit Ramp side	13.50 m
9	Average Depth of the Phase	15.70 m
10	Average EGL considered	RL - 42.50 m
11	Average Inner Side Slope area and slope length upto horizontal berm level	A = 27832Sq.m., Slope Length = 28.40 m
12	Average Inner Side Slope area and slope length from horizontal berm upto Earthen Bund Top level	A = 24043 Sq.m., Slope Length = 20.12 m
13	Horizontal Berm Area and Length of the berm	A = 5564Sq.m., Length = 1112 m
14	Therefore, Total Inner Side Slope area of the Phase – (11) + (12) + (13)	57439Sq.m.
15	Earthen Bund Height and Slope	6 m on all sides excluding Phase 1 side, Slope – 1:2.0 (V:H)
16	Therefore Total Inner Area of waste contact from Bottom to the top of the landfill (Earthen Bund Top) – (4) + (14)	80474Sq.m.
17	Top Service Road area and perimeter, 6 m wide at the top of the landfill	A = 5809 Sq.m., Avg. P = 968 m excluding Phase 1 side
18	Outer side Slope Area and Slope Length	A = 14064 Sq.m., Slope Length = 13.42 m
19	Entrance Approach area at EGL + Entrance Ramp 7 m (W) &140 m (L), Slope of 1:9.52 (V:H)	Entrance Approach Area = 174 Sq.m., Total Top Area = 980Sq.m. and Side Area of Entry Ramp = 1455 Sq.m. Slope length of ramps = 10.39 m
20	Exit Approach area at EGL + Exit Ramp 7 m (W) &140 m (L), Slope of 1:8.28 (V:H)	Exit Approach Area = 556 Sq.m., Total Top Area = 980Sq.m. and Side Area of Exit Ramp = 1673 Sq.m. Slope length of ramps = 11.95 m
21	Total Entrance and Exit Approach Ramps Volume	Entrance Ramp Volume = 10985 Cu.m. Exit Ramp Volume = 13279Cu.m.
22	Excavation Volume from EGL to Bottom in Slope of 1:2.0 (V:H)	241964Cu.m.
23	Excavation Volume Vertical in depth of 1.20 m to accommodate liners at Bottom of Phase	27642Cu.m.
24	Therefore Total Excavation Volume	269606Cu.m.
25	Volume of Excavated Soil in Back Filling in Phase to maintain Inner Side Slope	42080 Cu.m.
26	Volume of Excavated Soil used to construct Earthen Bund	129110Cu.m.
27	Volume of Excavated Soil used in Amended Clay Liner construction	78498Cu.m.

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NO	ITEM DESCRIPTION	QUANTITY
28	Volume of Excavated Soil used for construction of Entrance and Exit Approach Ramps	24264 Cu.m.
29	Volume of Excavated Soil used for Construction of embankment below ground level and additional soil required to retain embankment backside	199146 Cu.m.
30	Therefore Total Volume of Excavated Soil used on Site	473098Cu.m.
31	Hence Additional quantity of Soil brought from outside of premises within 5 km lead from site to match soil quantity for different works above	203492Cu.m.
32	Volume of Air space in the Phase up to Horizontal Berm from Bottom at an average height of 12.7 m from bottom	450799Cu.m.
33	Volume of Air Space between berm to Top of Earthen Bund at an average height of 9.0 m from the berm	579726Cu.m.
33	Volume of Air Space in the heap from top of landfill to the top of heap, 15 m high from Earthen Bund Top:	
34	Volume of Air Space in 1 st 5 m height (Total height of 5 m from Bund Top) in heap	36848 sq.m. x 5 m = 184240 Cu.m.
35	Volume of Air space in 1 st 5 m horizontal berm in heap	4950 sq.m. x 5 m = 24750 Cu.m.
A	Volume of Air Space in 2 nd 5 m height (Total height of 10 m from Bund Top) in heap	17632 sq.m. x 10 m = 176320 Cu.m.
B	Volume of Air space in 2 nd 5 m horizontal berm in heap	3872 sq.m. x 10 m = 38720 Cu.m.
C	Volume of Air Space in 3 rd 5 m height (Total height of 15 m from Bund Top) in heap upto top of the heap	11475 sq.m. x15 m = 172125 Cu.m.
D	So Total Volume of Air Space in Heap Above Earthen Bund Top	596155Cu.m.
E	Total Volume of Air Space from Bottom to Topmost point of landfill – (32) + (33) + (35D)	1626680Cu.m.
36	Less Volume of Liners applied on Inner Side Slope	51695Cu.m.
37	Net Volume or Capacity of Phase (35E-36)	1574985Cu.m.
38	Average Estimated Density of the Compacted Wastes	0.90 MT/Cu.m.
39	Capacity in terms of Weight of Wastes based on average density as mentioned above	1417487 MT
40	Leachate Collection System	Main Header leachate drain and lateral drains to be constructed with laid perforated HDPE pipes in the lateral drains and whole pipe in the main header drain laid with a sufficient slope and connected with 3 Nos. of leachate tanks

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NO	ITEM DESCRIPTION	QUANTITY
41	Leachate collection Pipes	<p>Lateral Pipes - 160 mm outer diameter size HDPE pipes of 10 Kg/cm² pressure grade and ISI make as per IS – 14333:1996 with material grade PE – 100 and material density of > 950 Kg/cm² and having holes of 10 mm @ center to center 140 mm distance in the upper half section of the pipes and having an arc length of 70 mm, throughout the length of the pipes shall be provided. The pipes are to be laid horizontally in the drainage layer at the bottom of the phase and shall be connected with the main header – whole HDPE pipe of 400 mm OD same grade as mentioned above. There shall be 3 Nos. of 315 mm OD main header pipes starting from the 400 mm header pipe and connected to the 3 Nos. of leachate wells. The pipes connecting the main header pipe are to be laid in such a way so as to make a slope of min. 2.0 % width wise and 1.13% length wise to allow leachate to flow easily in to the Leachate well.</p> <p>The pipes are to be laid in a leachate collection trench. Length of 160 mm dia. Pipes – 1456 m and Length of 315 mm dia pipes – 388 m and Length of 400 mm dia pipes – 60 m</p>
42	Leachate Collection Tanks	3 Nos. of clear Diameter 3 m x 23.715 m (H) constructed outside the phase
43	Liner System	<p>Single liner system at the base and the inner side slope of the landfill up to Earthen Bund Top. Bottom liner comprising of One layer of 900 mm thk. Amended Clay liner followed by Placement of 5 Kg. Sodium Bentonite Based Geo Synthetic Clay Liner for additional protection of prevention of leachate below bottom of the phase followed by placement of 1.5 mm HDPE liner protected with 1200 gsm PP Non woven geo textile liner and 300 mm thk. drainage layer with aggregates of varying size and coarse sand layers and having leachate collection pipes as mentioned above and the pipes connected with leachate wells. On the Side Slope placing of 900 mm thk. Amended Clay liner on the slope base followed by Placement of 5 Kg. Sodium Bentonite Based Geo Synthetic Clay Liner for additional protection of prevention of leachate below bottom of the phase followed by placement of 1.5 mm HDPE liner protected with 1200 gsm PP Non woven geo textile liner and covering of Geotextile with placement of 700 gsm of Geonet followed by 150 mm of RCC M30 to prevent liners and side slope against atmospheric damage. Drainage layer on the bottom shall be covered by 500 gsm PP Non woven Geo textile Liner to prevent clogging of drainage layer with leachate solids. Covering of all the liners on sides and bottom shall be done to prevent damage of the liners during operation of the landfill phase.</p>

**VOLUME - 1****TECHNICAL BID DOCUMENT****AHMEDABAD MUNICIPAL CORPORATION (AMC), SWM DEPARTMENT**

CONSTRUCTION OF SECURED LANDFILL PHASE 2 AT SURVEY NO. 337/P, AT SHAHWADI EKATRA, GYASPUR, AHMEDABAD FOR DISPOSAL OF PROCESSED MUNICIPAL SOLID WASTE

NO	ITEM DESCRIPTION	QUANTITY
44	Landfill Phase Gas Passive Venting System	160 mm outer diameter size HDPE perforated pipes shall be inserted after the phase is filled with waste upto the indicated height in the heap and the top cover liner has been placed.
45	Top Cover Liner System	It includes covering of waste with 1 st 600 mm thk. Amended clay liner followed by placement of 5 Kg GCL liner followed by 1.5 mm HDPE liner followed by 150 mm thk. Drainage layer finally covering the drainage layer with 450 mm thk. Vegetative soil cover and finally insertion of passive gas venting system as indicated above.
46	Storm Water Drain on GL to collect rain water	Length – 1108 m, Width – 1 m, Depth – 0.80 m
47	Toe Wall to protect Outer Side Slope	Length – 1108 m
48	Peripheral Road around the Phase on GL	Length – 1133 m, Width – 6 m
49	Green Belt Area	79236 Sq.m.
50	Life of Phase – 2	7.87 Years

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SECTION – 31**CONSTRUCTION DRAWINGS**

SR.NO.	DRAWING NO.	DETAIL OF DRAWING
1	AMC-2/SITE LAYOUT – 001	LAYOUT PLAN OF LANDFILL PHASE 2
2	AMC-2/SITE LAYOUT WITH CONTOUR – 001a	LAYOUT PLAN OF LANDFILL PHASE 2 WITH CONTOUR
3	AMC-2/SITE LAYOUT – 001b	LAYOUT PLAN OF LANDFILL PHASE 2 WITH WASTE DISPOSAL AREA IN HEAP ABOVE EARTHEN BUND
4	AMC-2/SECTION AND LINER DETAILS – 002	SECTION AND LINER DETAILS
5	AMC-2/SECTION AND DETAILS – 003	OTHER SECTIONS DETAILS
6	AMC-2/APPROACH RAMP SECTIONS – 004	APPROACH RAMPS SECTION DETAILS
7	AMC-2/LEACHATE COLLECTION TANK – 005	LEACHATE COLLECTION TANKS SECTION DETAILS
8	AMC-2/LEACHATE COLLECTION TANK – 005a	LEACHATE COLLECTION TANKS PLAN DETAILS
9	AMC-2/LEACHATE COLLECTION SYSTEM – 006	LEACHATE COLLECTION SYSTEM DETAILS
10	AMC-2/KEY SITE PLAN – 007	KEY SITE PLAN
11	AMC-2/LAYOUT WITH EARTHWORK-008	LAYOUT PLAN WITH EARTHWORK DETAILS
12	AMC-2/LEACHATE DISPOSAL TANK - 009	LEACHATE DISPOSAL TANK DETAILS



VOLUME - 1

TECHNICAL BID DOCUMENT

AHMEDABAD MUNICIPAL CORPORATION (AMC), SWM DEPARTMENT

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SECTION – 32

SOIL TESTING REPORT OF THE SITE

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FINAL REPORT

GEOTECHNICAL/SUB-SOIL INVESTIGATION WORK

FOR A SECURED LANDFILL PHASE-2 PROJECT IN

SURVEY NO.337/p, MOJE: SHAHWADI, GYASPUR

TA.: AHMEDABAD, DIST. : AHMEDABAD, STATE:GUJARAT

REPORT NO. : 2201/EI-894/S-187/21

MONTH & YEAR : JANUARY, 2022

SUBMITTED TO

AHMEDABAD MUNICIPAL CORPORATION

AHMEDABAD.

PREPARED BY

**THE GUJARAT INSTITUTE OF CIVIL ENGINEERS AND ARCHITECTS,
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Date :20/02/2022

To,
Ahmedabad Municipal Corporation
Danapith, Ahmedabad.

Sub.: Report for the soil investigation work for a Secured Landfill Phase-2 Project
at Survey No.:337/p
Moje: Shahwadi, Gyaspur, Ta.: Ahmedabad, Dis. Ahmedabad

We have conducted the soil investigation work at above mentioned site.

.Along with this letter we are submitting the soil report for the same along with the SBC analysis.

Please call us for further information and clarification.

Thanking You,

For, GICEA

MATERIAL TESTING & N.C.PATEL SOIL TESTING LABORATORY,

Deel MAT LAB
REG. NO.
17140
Authorised Signatory

Encl.

- 1.Two copy of Report
- 2.One report in soft copy

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[1] INTRODUCTION :

Ahmedabad Municipal Corporation for project-Construction of proposes geotechnical investigation work for Secured Landfill Phase-2 Project in Survey No.:337/p, Shahwadi, Gyashpur Dist :Ahmedabad. in Gujarat state.

The purpose of the investigations was to determine the sub soil stratification of the soil, geotechnical information & safe bearing capacity of the soil, so as to provide information that will assist the structural engineers in the design of the foundations and the relevant works.

The Job was carried out under the guidance and supervision of the soil personnel of G.I.C.E.A Laboratory,Ahmedabad, and client's engineer.

[2] FIELD WORK :

- 1) Drilling Seven nos. of 150 mm dia borehole with casing whenever required up to maximum depth of BH-1,2,3,5,7,-20m and BH-4 & BH-6 ,40mtr. from ground level.
- 2) Carryout standard penetration test at regular interval alternate to undisturbed sampling
- 3) Collecting disturbed soil samples at regular interval as per the stratification of soil ,recording depth at which soil changes.
- 4) Collecting undisturbed samples (UDS) at regular interval alternate to SP Test or continuous UD samples at regular interval if subsoil is cohesive.

[2.1] Borehole Drilling :

Drilling of 150 mm dia borehole was carried out by tractor mounted rotary drilling method above water table. Water was added while drilling but stopped at enough height above the test level to avoid disturbance. Drilling below water table was made by percussion drilling method casing is required to be lowered if holes do not retain its shape. Care is taken to maintain ground water table during drilling and particularly before testing or sampling levels. In no case casing is allowed to advance below the bottom of borehole. Chiselling is carried out if required while drilling .The Location of borehole was decided with due consideration of Client/Consultant of the project





(2.2) Collection of Samples:

Undisturbed soil samples in shelly tubes were collected in the thin walled sampling tubes in accordance with IS. The sampling tube was connected to the rod by jarring link in case of \emptyset tubes. A' drill rods were connected by suitable adaptor with ball check valve. Sampling tube was pushed into the borehole by pressure hammering as per the soil stiffness. The sampling tubes were waxed immediately after removal.

In case of medium to coarse grained, non-cohesive sand samples, where sampling is unsuccessful, Standard Penetration Tests was carried out after cleaning the borehole.

However, disturbed soil samples from shell or split spoon samplers were also collected in polythene bags with proper levels during drilling for finding index properties of the soil and transported to our laboratory.

[2.3] Standard Penetration Test :

The Standard Penetration Tests (SPT) (IS-2131, 1981) was carried out in the bore hole at predetermined depths. It gives indirect evaluation of strength-deformation characteristics of the sub soil. The test includes driving a split spoon sampler using a 63.5 kg hammer with a free fall of 750mm. The first 15cm is considered as seating drive. The No. of blows required to penetrate next 30 cm is reported as N-value. Empirical relations are established to correlate N-Value with the shear parameters or bearing capacity of soil. A disturbed soil sample is collected inside the split spoon sampler which can be used to find soil classification and In-situ water content.

If the no. of blows exceeds 50 before desired penetration is achieved, it is reported as N- value >50 with the actual penetration achieved.

[2.4] Ground Water Table

Ground Water table was not encountered in the borehole up to 20.00m depth for BH-1,2,3,5,7,-20m below EGL, and water table show in BH-4 & BH-6 20.1mtr when investigation carried out in the month of (January-2022).





[3] LABORATORY WORK

The laboratory tests on soil samples were started immediately after the receipt of the same in the laboratory. Following laboratory tests are carried out to determine the physical and engineering properties of undisturbed and disturbed soil samples.

1. Dry Density and Natural Moisture Content (IS - 2720, Part – II)
2. Particle Size Analysis (IS - 2720, Part – IV, 1985)
3. Atterberg's Limit (IS -2720, Part – V, 1985)
4. Specific Gravity (IS -2720, Part – III, 1980)
5. Test for Shear properties of selected samples (IS -2720, Part-XI)

The common practice adopted in the field and laboratory testing by & large are as per I S code indicated . Results of the laboratory tests performed on various soil samples are presented in the form of table at the end of report.

[4.0] PHYSICAL PROPERTIES:-

The moisture cans collected from SPT samplers from the field are weighed and placed in oven for drying to determine natural moisture content(NMC). Results are tabulated in table

UDS are extracted using screw type extractor and samples were prepared as per the required size of the test. Weight and volume of the samples were noted before extracting from tubes. Average bulk density is calculated and samples were placed in oven to get the field moisture content for computing the dry density as per IS formula. Results are tabulated in table.

Specific gravity with specific gravity bottle/ pycnometer is calculated as per IS 2720-part-3.

Grain size analysis is made by IS-2720-Part-4 sieves of sizes

4.75mm,2.00mm,1.00mm,0.425mm,0.25mm and

0.075mm. For coarse grained soil a graph of particle size v/s cumulative % finer is plotted.

For fine grained soil wet analysis is made on plummet balance. Results are tabulated in table



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Liquid limit and Plastic Limit tests are carried out with distilled water as per IS 2720 part – 5. Liquid and Plastic Limits are determined by using procedure given in IS: 2720, Part-V, 1985. The results are given in result sheet. Use testing method Casagrande method. A soil sample weighing about 150gm from the thoroughly mixed portion of soil passing 425 micron was used for testing.

The soil samples showing high plasticity were checked for swelling and shrinkage. Firstly for rough estimate, free swell test is carried out as per IS 2720 part – 40. Shrinkage limit test is carried out as per IS 2720 part 6.

[5.0] SHEAR PROPERTIES:-

Shear tests were carried out by three methods.

- 1) Unconfined compressive strength as per IS 2720 part-10 for the saturated plastic soil
- 2) Triaxial shear test is tube carried out on samples of size 38mm dia and 76 mm in height on motorized 30 speed load frame. The confining pressure 63 is applied to the cell by oil water constant pressure system. The tests are carried out for the three conditions
 - a) Unconsolidated Undrained (UU) test without pore water pressure measurement as per IS 2720 part I
 - b) Consolidated Undrained (CU) test without pore water pressure measurement as per IS 2720 part II

The condition decided on type of sample and water table condition or designers specifications.

- 3) Direct/box shear test on noncohesive medium to coarse sandy soil as per IS 2720 part 13. The graph for triaxial shear test is plotted by modified method.

6.0 SUB SOIL STRATIFICATION

Field and laboratory test data reveal the general stratification in mention in the Table



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7.0 COMPUTATION OF SAFE BEARING CAPACITY

The following formula is used for calculating ultimate net bearing capacity in the case of footings: (Ref: IS: 6403 - 1981)

a) In case of general shear failure:

$$q_d = C N_c + q (N_q - 1) 0.5 B \gamma N_\gamma$$

b) In case of local shear failure:

$$q_d' = 2/3 C N_c' + q (N_q' - 1) + 0.5 B \gamma N_\gamma'$$

The ultimate net bearing capacity obtained for footing is modified to take into account, the shape of the footing, inclination of loading, depth of embedment and effect of water table. The modified bearing capacity formula is given as under:

a) In case of general shear failure:

$$q_d = C N_c S_c d_c i_c + q (N_q - 1) S_q d_q i_q + 0.5 B \gamma N_\gamma S_\gamma d_\gamma i_\gamma W'$$

b) In case of local shear failure:

$$q_d' = 2/3 C N_c' S_c d_c i_c + q (N_q' - 1) S_q d_q i_q + 0.5 B \gamma N_\gamma' S_\gamma d_\gamma i_\gamma W'$$

c) In case of stiff cohesive soil:

$$q_d = C N_c S_c d_c i_c$$

Shape Factor	S_c	S_q	S_γ
Continuous strip	1.00	1.00	1.00
Rectangular	$1 + 0.2 (B/L)$	$1 + 0.2 (B/L)$	$1 - 0.4 (B/L)$
Square	1.30	1.20	0.80
Circle	1.30	1.20	0.60

Depth Factor	
d_c	$1 + 0.2 \frac{D_f}{B} \sqrt{N_\phi}$, Where $\sqrt{N_\phi} = \left(45 + \frac{\phi}{2}\right)$
$d_q = d_\gamma$	1 for $\phi < 10$ degree
$d_q = d_\gamma$	$1 + 0.1 \frac{D_f}{B} \sqrt{N_\phi}$, for $\phi > 10$ degree

Considering applied load as vertical, $i_c = i_q = i_\gamma = 1.0$



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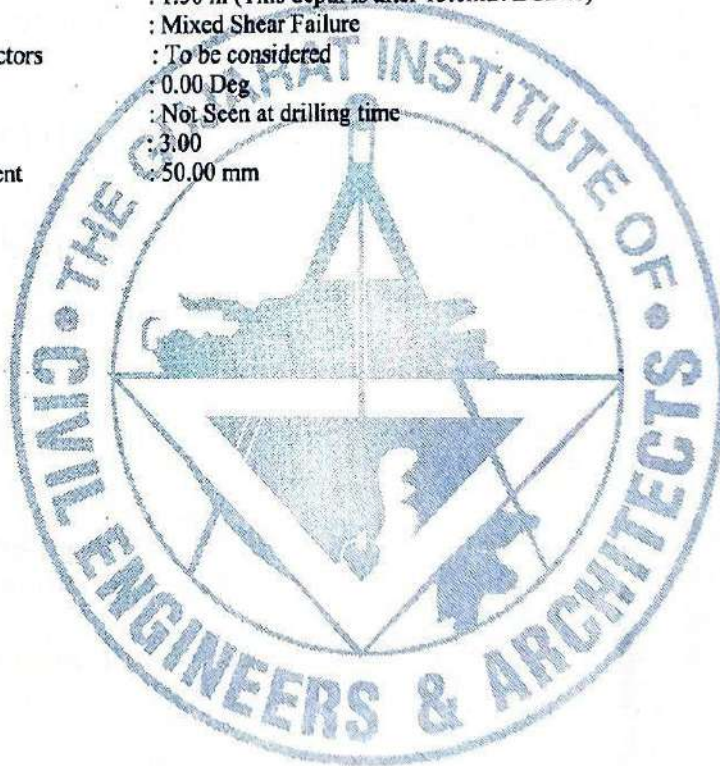
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Design Data :

Foundation Type	: Square Footing
Width of Footing	: 2.0 m
Depth of Footing	: 1.50 m (This depth is after 15.0mtr. EGL to)
Failure Mode	: Mixed Shear Failure
Shape and Depth Factors	: To be considered
Load inclination	: 0.00 Deg
Water Table	: Not Seen at drilling time
Factor of Safety	: 3.00
Permissible Settlement	: 50.00 mm



ESTD. : 1947



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8.) SUMMARY OF SAFE BEARING CAPACITY

Sr. No	BH NO	Length m	Width (m)	Depth (m)	q _{safe} T/m ²	Settlement (mm)
1	BH-1	2.0	2.0	1.50	35.59	29.60
2		2.0	2.0	2.00	36.21	27.62
3		2.0	2.0	2.50	36.86	26.31
4		2.0	2.0	3.00	37.53	25.35
5		3.0	3.0	1.50	35.69	48.62
6		3.0	3.0	2.00	36.27	45.46
7		3.0	3.0	2.50	36.87	42.42
8		3.0	3.0	3.00	37.48	40.43
1	BH-2	2.0	2.0	1.50	35.89	29.83
2		2.0	2.0	2.00	36.59	27.88
3		2.0	2.0	2.50	37.31	26.60
4		2.0	2.0	3.00	38.07	25.67
5		3.0	3.0	1.50	36.01	48.98
6		3.0	3.0	2.00	36.66	45.88
7		3.0	3.0	2.50	37.32	42.87
8		3.0	3.0	3.00	38.01	40.91
1	BH-3	2.0	2.0	1.50	35.74	33.05
2		2.0	2.0	2.00	36.39	30.80
3		2.0	2.0	2.50	37.08	29.33
4		2.0	2.0	3.00	37.80	28.24
5		3.0	3.0	1.50	35.85	54.36
6		3.0	3.0	2.00	36.46	50.79
7		3.0	3.0	2.50	37.09	47.34
8		3.0	3.0	3.00	37.74	45.09
1	BH-4	2.0	2.0	1.50	35.83	33.13
2		2.0	2.0	2.00	36.53	30.90
3		2.0	2.0	2.50	37.25	29.45
4		2.0	2.0	3.00	38.01	28.38
5		3.0	3.0	1.50	35.94	54.48
6		3.0	3.0	2.00	36.59	50.94
7		3.0	3.0	2.50	37.26	47.52
8		3.0	3.0	3.00	37.94	45.29



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Sr. No	BH NO	Length m	Width (m)	Depth (m)	Q _{safe} T/m ²	Settlement (mm)
1	BH-5	2.0	2.0	1.50	35.64	32.96
2		2.0	2.0	2.00	36.40	30.81
3		2.0	2.0	2.50	37.20	29.41
4		2.0	2.0	3.00	38.03	28.40
5		3.0	3.0	1.50	32.00	49.5
6		3.0	3.0	2.00	35.00	49.1
7		3.0	3.0	2.50	37.20	47.46
8		3.0	3.0	3.00	37.96	45.30
1	BH-6	2.0	2.0	1.50	35.46	32.81
2		2.0	2.0	2.00	36.34	30.76
3		2.0	2.0	2.50	37.24	29.46
4		2.0	2.0	3.00	38.21	27.04
5		3.0	3.0	1.50	32.00	49.32
6		3.0	3.0	2.00	34.00	47.86
7		3.0	3.0	2.50	37.25	47.57
8		3.0	3.0	3.00	38.13	45.53
1	BH-7	2.0	2.0	1.50	38.62	30.09
2		2.0	2.0	2.00	40.52	28.87
3		2.0	2.0	2.50	42.43	28.22
4		2.0	2.0	3.00	44.52	27.92
5		3.0	3.0	1.50	39.05	49.49
6		3.0	3.0	2.00	40.81	47.43
7		3.0	3.0	2.50	42.53	45.22
8		3.0	3.0	3.00	44.55	44.19

• This Depth is consider after 15.00mtr EGL to

For,,G.I.C.E.A.,

MATERIAL TESTING & N.G.PATEL SOIL TESTING LABORATORY,

Devi
Authorised Signatory

GICEA-2201-EI-903-Gyashpur

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9] CONCLUSIONS & RECOMMENDATION:

(9.1) The site for proposed soil investigation work at Gyashpur, general is observed to consist of Fine sandy, silty, Little portion clayey soil. soil up to BH-1,2,3,5,7,-20m and BH-4 & BH-6, 40mtr depth of termination.

(9.2) The net safe bearing capacity of open foundation having width varying from 1.5 to 2.5 m at 1.50 m to 3.0 m depth (after 15.0mtr EGL to) is recommended in following paras considering 50 mm maximum permissible settlement and in natural condition of soil. For individual depth and size of footing please refer table on page no.11 of this report.

(9.3) If the soil strata encountered during actual excavation are found different from strata mentioned in the report, the matter should be reported to us for reconsideration.

(9.4) The results of the laboratory tests are incorporated in the form of table at the later part of the report.

(9.5) If you more accurate SBC than you can Plat load test at site

For,,G.I.C.E.A.,

MATERIAL TESTING & N.G.PATEL SOIL TESTING LABORATORY ,



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CLASSIFICATIONS:

- GW:** Well graded gravels, gravel sand mixture or no fines
- GP :** Poorly graded gravels or gravels sand mixture, little or no fines
- GM:** Silty gravels, poorly graded gravel-sand-silt mixtures
- GC :** Clayey gravels, poorly graded gravels-sand-clay mixtures
- SW :** Well graded sands, gravelly sands, little or no fines
- SP :** Poorly graded sands or gravelly sands, little or no fines
- SC :** Claye sands, poorly graded sand-clay mixture
- SM:** Silty sands, poorly graded sand-silt mixture
- ML:** Inorganic silt and very fine sands, silty or clayey fine sands or clayey silt with non to low plasticity
- CL:** Inorganic clays, gravelly clays, sandy clays, silty clays, lean clays of low plasticity
- OL:** Organic silts and organic silty clay of low plasticity
- MI:** Inorganic silts, silty or clayey fine sands or clayey silts of medium plasticity
- CI:** Inorganic clays, gravelly clays, sandy clays, silty clays, lean clays of medium plasticity
- OI :** Organic silts and silty clay of medium plasticity
- MH:** Inorganic silt of high compressibility, micaceous or diatomaceous fine sandy or silty soils, elastic silts
- CH:** Inorganic clays of high plasticity, fat clays
- OH:** Organic clays of medium to high plasticity
- Pt.:** Peat and other highly organic soil with very high compressibility



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ABBREVIATIONS

DS : Disturbed Soil Sample

UDS : Undisturbed Soil Sample

SPT : Standard Penetration Test

SBC : Safe Bearing Capacity

NP : Non Plastic

DST : Direct Shear Test

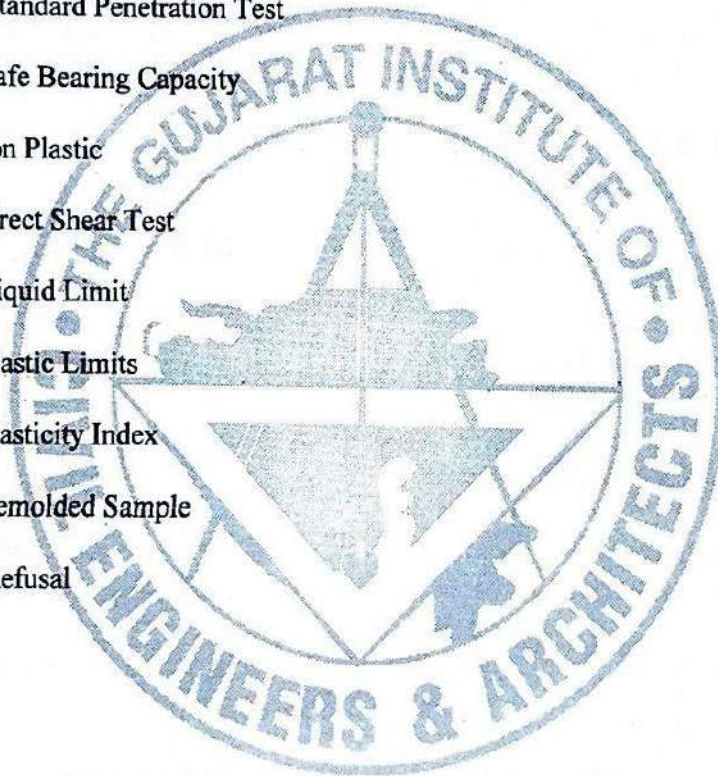
LL : Liquid Limit

PL : Plastic Limits

PI : Plasticity Index

***** : Remolded Sample

Ref. : Refusal



ESTD. : 1947



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3. The test report do not indicate the quality of the product or usage of product or suitability of the product or material.
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For, G.I.C.E.A.,

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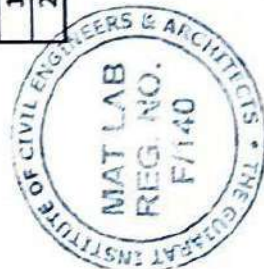
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SOIL CHARACTERISTICS TABLE																			
Project name:		Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi, Gyashpur, Ta. & Dis.: Ahmedabad																	
Client Name:		Ahmedabad Municipal Corporation																	
Water Table		Not Seen at Drilling Time																	
Depth mtr.	Sample Type	SPT-N Value	Instn Water Content	Density (gm/cc)		Specific Gravity	Particle Size Analysis (%)			Liquid Limit	Plasticity Index	Classification	Type of Shear Test	Cohesion C (kg/cm ²)	Angle of Friction ϕ	Compression Index, Cc	Free Well	Shrinkage Limit	Bore Hole No.: 02-01-2022
							Gr	Sa	Silt+ Clay										
0.00 DS			4.17	Bulk	Dry		0	51.7	48.3	24.00	0.00 SM								
1.50 UDS			9.59	1.71	1.56		2.2	11	86.8	34.03	14.23 CL	TUU		0.12	18				
3.00 SPT		31	7.24				0	12.8	87.2	29.93	6.93 ML-CL								
4.50 UDS			7.53	1.85	1.72	2.65	1.5	4.8	93.7	30.45	10.85 CL	TUU		0.2	16.9	0.085	22.6		
6.00 SPT		43	7.53				3.1	45.3	51.6	30.78	11.58 CL								
7.50 UDS			6.67	1.93	1.81	2.66	4.2	49.2	46.6	27.00	7.00 SM-SC	DUU		0.09	29				
9.00 SPT		74	6.95				7.3	47.4	45.3	31.99	12.69 SC								
10.50 UDS			9.89	1.95	1.77	2.66	7.2	21.7	71.1	31.35	11.45 CL	TUU		0.15	24				
12.00 SPT		>100	8.70				8.1	35	56.9	31.74	13.84 CL								
13.50 UDS			8.40	1.99	1.84	2.65	0.4	19.1	80.5	31.77	12.27 CL	TUU		0.16	14.6				
15.00 SPT		>100	9.89				1	29.7	69.3	30.51	9.11 CL								
16.50 UDS			12.35	2.1	1.87	2.67	8.6	18.2	73.2	29.75	9.45 CL	TUU		0.22	12.9				
18.00 SPT		>100	5.54				0	83.3	16.7	0.00	0.00 SM								
20.00 SPT		>100	10.70				2.8	76.8	20.4	0.00	0.00 SM								



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SPT & DEPTH DESCRIPTION						
Project Name:	Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad					
Client Name:	Ahmedabad Municipal Corporation					
Borehole No	1				Termination Depth : 20.00 meter	
Diameter of Boring	150 mm					
Depth(m)	Description of Sample	SYMBOL/ MATCHING	Thickness of Strata(m)	Sampling Type	Sample Depth (m)	SPT Value Number
0.00	Brownish sand, silt mix with non plasticity	SM	0.60	DS	0	
1.00						
2.00	Brownish Clay,sand mix with little portion gravels with low plasticity	CL	1.10	UDS	1.50	
3.00	Yellowish brown clay,silt,sand mix with very low plasticity	ML-CL	1.50	SPT	3.00	31
4.00				UDS	4.50	
5.00	Yellowish brownClay,sand mix with little portion gravels with low plasticity	CL	3.10	SPT	6.00	43
6.00				UDS	7.50	
7.00	Yellowish brown sand silt with little portion clay & gravels mix with non to low plasticity	SM-SC/SC	2.80	SPT	9.00	74
8.00				UDS	10.50	
11.00	Yellowish brownClay,sand mix with little portion gravels with low plasticity	CL	7.80	SPT	12.00	31+44+50/7CM>100
12.00				UDS	13.50	
13.00				SPT	15.00	45+50/6CM>100
14.00				UDS	16.50	
15.00				SPT	18.00	34+67/7CM>100
16.00				UDS	19.50	
17.00	Yellowish brown sand,silt mix with non plasticity	SM	3.1	SPT	21.00	57+50/6cm>100
18.00						
19.00						
20.00						

Abbreviation: DS-Disturbed Sample, UDS-Un-Disturbed Sample,SPT-Standard Penetration Test, SC- Clayey Sand,SM-Silty Sand, CL-Silty Clay Having Low Plasticity



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SOIL CHARACTERISTICS TABLE																														
Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi, Gyashpur, Ta.& Dis.: Ahmedabad																														
Ahmedabad Municipal Corporation																														
Not Seen at Drilling Time																														
Bore Hole No.: 2																														
Bore Hole Completed on: 01-01-2022																														
Sample Type		SPT-N Value		Insitu Water Content		Density (gm/cc)		Specific Gravity		Particle Size Analysis (%)			Liquid Limit		Plasticity Index		Classification		Type of Shear Test		Cohesion C		Angle of Friction ϕ		Compression Index, C_c		Frees Well		Shrinkage Limit	
mtr.	spt/uds/ds	Nos.	%	Bulk	Dry	Gr	Sn	Clay	%	%	%	%	%	%	%	%	%	(kg/cm ²)	($^{\circ}$)											
0.00 DS			3.09			1.5	41.9	56.6	33.03					12.53	CL															
1.50 SPT		10	9.59			1.4	13.5	85.1	31.34					12.04	CL															
3.00 UDS			8.70	1.75	1.61	2.64	2.7	8.8	88.5	30.81				7.91	ML-CL															
4.50 SPT		36	9.29				1.7	74.4	23.9	0.00				0.00	SM															
6.00 UDS			7.03	1.78	1.66	2.65	1.6	21.8	76.6	31.27				11.97	CL															
7.50 SPT		80	3.81				7.7	38	54.3	30.41				11.91	SC															
9.00 UDS			6.95	1.85	1.73	2.66	9.2	22.4	68.4	31.37				10.27	SC															
10.50 SPT		74	8.40				1.2	40.3	58.5	29.95				10.95	CL															
12.00 UDS			9.59	1.92	1.75	2.65	1.8	16.8	81.4	31.14				11.24	CL															
13.50 SPT		85	7.14				4.7	40.6	54.7	31.89				12.69	CL															
15.00 UDS			9.89	2	1.82	2.66	5.7	56.8	37.5	28.91				7.71	SM-SC															
16.50 SPT		>100	11.42				2	43.3	54.7	30.32				10.42	CL															
18.00 UDS			11.11	2.09	1.88		12.6	22	65.4	30.81				10.71	CL															
20.00 SPT		>100	8.99				0	52.8	47.2	30.65				10.25	CL															



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SPT & DEPTH DESCRIPTION

ESTD. : 1947

Geotechnical Investigation for CONSTRUCTION OF Secured Landfill						
Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad						
Client Name: Ahmedabad Municipal Corporation						
Borehole No	2					
						Termination Depth :20.00 meter
Diameter of Boring :	150 mm					
Depth(m)	Description of Sample	SYMBOL/ HATCHING	Thickness of Strata(m)	Sampling Type	Sample Depth (m)	SPT Value Number
0.00				DS	0	
1.00	Brownish Clay,sand mix with little portion gravels with low plasticity	CL	1.80	SPT	1.50	10
2.00						
3.00	Yellowish brown clay,sil,sand mix with very low plasticity	ML-CL	1.40	UDS	3.00	
4.00				SPT	4.50	36
5.00	Yellowish brown Sand & silt mix with non plasticity	SM	1.10	UDS	6.00	
6.00	Yellowish brown Clay,sand mix with little portion gravels with low plasticity	CL	1.70	SPT	7.50	80
7.00						
8.00	Yellowish brown sand ,silt with little portion clay & gravels mix with low plasticity	SC	3.10	UDS	9.00	
9.00				SPT	10.50	74
10.00						
11.00	Yellowish brown Clay,sand mix with little portion gravels with low plasticity	CL	4.40	UDS	12.00	
12.00				SPT	13.50	85
13.00						
14.00	Yellowish brown sand,silt mix with non plasticity	SM	0.90	UDS	15.00	
15.00				SPT	16.50	36+70/7cm>100
16.00	Yellowish brown Clay,sand mix with little portion gravels with low plasticity	CL	5.63	UDS	18.00	
17.00				SPT	21.00	64+40/4cm>100
18.00						
19.00						
20.00						

Abbreviation: DS-Disturbed Sample, UDS Un Disturbed Sample,SPT Standard Penetration Test, SC- Clayey Sand,SM-Silty sand, CL-Silty Clay Having Low Plasticity





SOIL CHARACTERISTICS TABLE														
Project name: Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO-337/p Shahwadi, Gyashpur, Ta.& Dis.: Ahmedabad														
Client Name: Ahmedabad Municipal Corporation														
Water Table Not Seen at Drilling Time														
Depth mtr.	spt/nds/ds	Nos.	SPT-N Value		Insitu Water Content		Density (gm/cc)		Specific Gravity		Particle Size Analysis (%)			Classification
			%	Bulk	Dry	Gr	Sa	Clay	Silt	%	Plasticity Index	Liquid Limit	Angle of Friction ϕ	Compression Index, C_c
0.00 DS			9.89			0.7	66.5	32.8		33.03	12.53	CL		
1.50 SPT		4	9.29			2.3	30.9	66.8		31.34	12.04	CL		
3.00 UDS			8.70	1.7	1.56	2.1	46.2	51.7		30.81	7.91	ML-CL	8	19.5
4.50 SPT		5	8.40			1.2	63.2	35.6		31.00	14.00	SC		
6.00 UDS			11.11	1.79	1.61	1.1	20.7	68.3		31.27	11.97	CL	11	0.1
7.50 SPT		13	14.29			1.6	62.8	35.6		30.41	11.91	SC		
9.00 UDS			11.32	1.82	1.63	7.4	72.1	20.5		31.37	10.27	SC	23	
10.50 SPT		30	12.36			5.5	62	32.5		29.95	10.95	SC		
12.00 UDS			9.89	1.91	1.74	1.2	35.3	63.5		31.14	11.24	CL	18	24.6
13.50 SPT		46	11.42			0.5	30.8	68.7		31.89	12.69	CL		
15.00 UDS			8.70	1.99	1.83	2.4	57.4	40.2		30.96	11.06	SC	28.6	
16.50 SPT		>100	8.70			16.2	30.6	53.2		32.00	13.00	CL		
18.00 UDS			9.59	2.09	1.91	17.4	24.8	57.8		30.81	10.71	CL	13.2	
20.00 SPT		>100	6.38			0	89.8	10.2	NP	NP	NP	SM		



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SPT & DEPTH DESCRIPTION						
Project Name:	Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad					
Client Name	Ahmedabad Municipal Corporation.					
Borehole No	3				Termination Depth :10.00 meter	
Diameter of Boring :	150 mm					
Depth(m)	Description of Sample	SYMBOL/ NATURAL G	Thickness of Strata(m)	Sampling Type	Sample Depth (m)	SPT Value Number
0.00	Dark Brown Clay,Sand mix with low plasticity index	CL	2.80	OS	0	
1.80				SPT	1.50	4
2.00						
3.00	Yellowish brown Clay,silt & sand mix with low plasticity	ML-CL	2.00	UDS	3.00	
4.00	Yellowish brown sand,clay and little portion gravels mix with low plasticity	SC	1.20	SPT	4.50	5
5.00				UDS	6.00	
6.00						
7.00	Yellowish brown Clay,Sand mix with low plasticity index	CL	1.20	SPT	7.50	13
8.00	Yellowish brown sand,clay and little portion gravels mix with low plasticity	SC	4.20	UDS	9.00	
9.00				SPT	10.50	30
10.00				UDS	12.00	
11.00	Yellowish brown Clay,Sand little portion gravels mix with low plasticity index	CL	3.40	SPT	13.50	46
12.00				UDS	15.00	
13.00						
14.00	Yellowish brown sand,clay and little portion gravels mix with low plasticity	SC	1.20	SPT	16.50	48-50-100
15.00				UDS	18.00	
16.00						
17.00	Yellowish brown Clay,Sand little portion gravels mix with low plasticity index	CL	3.10	SPT	20.00	70+35/2cm>100
18.00				UDS		
19.00						
20.00	Yellowish brown sand,silt mix with non plasticity	SM	0.9	SPT	20.00	70+35/2cm>100
Abbreviation: OS-Disturbed Sample, UDS-Un-Disturbed Sample,SPT-Standard Penetration Test, SC- Clayey Sand,SM-Silty Sand, CL-Silty Clay Having Low Plasticity						





SOIL CHARACTERISTICS TABLE																					
Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad																					
Ahmedabad Municipal Corporation										Bore Hole No.:					4						
Water Table		Seen at 20.1mtr Drilling Time			Bore Hole Start Date:				03-01-2022			Bore Hole Completed on:					05-01-2022				
Depth	Sample Type	spt/uds/ds	Nos.	SPT-N Value	Insitu Water Content	Density (gm/cc)		Specific Gravity	Particle Size Analysis (%)				Liquid Limit	Plasticity Index	Classification	Type of Shear Test	Cohesion C	Angle of Friction ϕ	Compression Index, C _c	Frees Well	Shrinkage Limit
						Bulk	Dry		Gr	Sn	Silt+	Clay									
mtr.					%																
0.00 DS					6.95				1.6	67.7	30.7	32.34	11.84	CL							
1.50 SPT			17		4.71				4.3	21.7	74	31.20	11.90	CL							
3.00 UDS					9.29	1.72	1.57	2.63	4.6	9.6	85.8	31.10	8.20	ML-CL							
4.50 SPT			36		4.71				3.4	22.6	74	0.00	0.00	SM							
6.00 UDS					13.31	1.88	1.66	2.64	7.3	61	31.7	30.72	11.42	SC							
7.50 SPT			45		2.74				3.1	67.6	29.3	29.98	11.48	SC							
9.00 UDS					5.26	1.82	1.73	2.66	2.2	53.3	44.5	0.00	0.00	SM	DUU	0	30.9				
10.50 SPT			51		6.76				0	65.3	34.7	0.00	0.00	SM	DUU						
12.00 UDS					9.29	1.92	1.76	2.65	1.8	54.8	43.4	0.00	0.00	SM	DUU	0	31.3		11.6		
13.50 SPT			70		11.52				4.2	51	44.8	28.54	9.34	CL							
15.00 UDS					5.54	1.92	1.82	2.66	5	32.3	62.7	30.27	9.07	CL	TUU	0.18	17.2		20.6		
16.50 SPT			>100		9.09				1.6	43.4	55	30.12	10.22	CL							
18.00 UDS					25.00	2.29	1.83		1.4	42.8	55.8	32.76	12.66	CL	TUU	0.21	14.4				
19.50 SPT			>100		6.95				0	43.6	56.4	30.05	9.65	CL							



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Depth	Sample Type	SPT-N Value	In situ Water Content	Density (gm/cc)		Specific Gravity	Particle Size Analysis (%)				Liquid Limit	Plasticity Index	Classification	Type of Shear Test	Cohesion C (kg/cm ²)	Angle of Friction ϕ	Compression Index, Cc	Frees Well	Shrinkage Limit
mtr.	spt/uds/ds	Nos.	%	Bulk	Dry		Gr	Sn	Silt+	Clay									
21.00 DS			6.67				12.5	56.7	30.8	0.00	0.00	0.00	SM	DUU	0	32.6			
22.50 SPT		>100	12.36				0	81	19	0.00	0.00	0.00	SM						
24.00 UDS			13.64	2.10	1.85		0	62	38	0.00	0.00	0.00	SM	DUU	0	32.8			
25.50 SPT		>100	10.50				0	83.3	16.7	0.00	0.00	0.00	SM						
27.00 UDS			8.40	2.04	1.88	2.66	11.9	37.1	51	31.74	12.04	12.04	SC	DUU	0.1	25.9			
28.50 SPT		>100	6.76				5.8	51.7	42.5	31.20	11.70	11.70	SC						
30.00 UDS			11.73	2.10	1.88		4.7	61.2	34.1	29.98	10.38	10.38	SC						
31.50 SPT		>100	10.62				1.9	72.8	25.3	0.00	0.00	0.00	SM						
33.00 UDS			11.42	2.11	1.89		0	55.3	44.7	0.00	0.00	0.00	SM						
34.50 SPT		>100	9.89				0	53.4	46.6	0.00	0.00	0.00	SM						
36.00 DS			11.11				0	69.1	30.9	0.00	0.00	0.00	SM						
37.50 SPT		>100	12.18				6.5	42.9	50.6	29.93	7.83	7.83	CL						
39.00 UDS			12.36	2.20	1.96		1.9	48.5	49.6	30.21	8.61	8.61	CL						
40.00 SPT		>100	22.22				1.7	37.6	60.7	29.30	8.10	8.10	CL						



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SPT & DEPTH DESCRIPTION						
Project Name:	Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad					
Client Name:	Ahmedabad Municipal Corporation					
Borehole No:	4				Termination Depth 40.00 meter	
Diameter of Boring :	150 mm					
Depth(m)	Description of Sample	SYMBOL/ HATCHING	Thickness of Strata(m)	Sampling Type	Sample Depth (m)	SPT Value Number
0.00				DS	0	
1.00	Brownish Clay,sand mix with little portion gravels with low plasticity	CL	2.90	SPT	1.50	17
2.00						
3.00				UDS	3.00	
4.00	Yellowish brown clay,sil,sand mix with very low plasticity	ML-CL	1.60	SPT	4.50	36
5.00						
6.00	Yellowish brown Sand & silt mix with non plasticity	SM	1.00	UDS	6.00	
7.00						
8.00	Yellowish brown sand,silt with little portion clay & gravels mix with low plasticity	SC	3.10	SPT	7.50	45
9.00				UDS	9.00	
10.00				SPT	10.50	51
11.00				UDS	12.00	
12.00						
13.00				SPT	13.50	70
14.00						
15.00				UDS	15.00	
16.00				SPT	16.50	41+60/10cm>100
17.00				UDS	18.00	
18.00						
19.00				SPT	19.50	34+70/7cm>100
20.00					21.00	
21.00				DS		
22.00					22.50	
23.00	Yellowish silty sand, fine sand with gravels	SM	5.9	SPT		45+50/7cm>100



MATERIAL TESTING LABORATORY

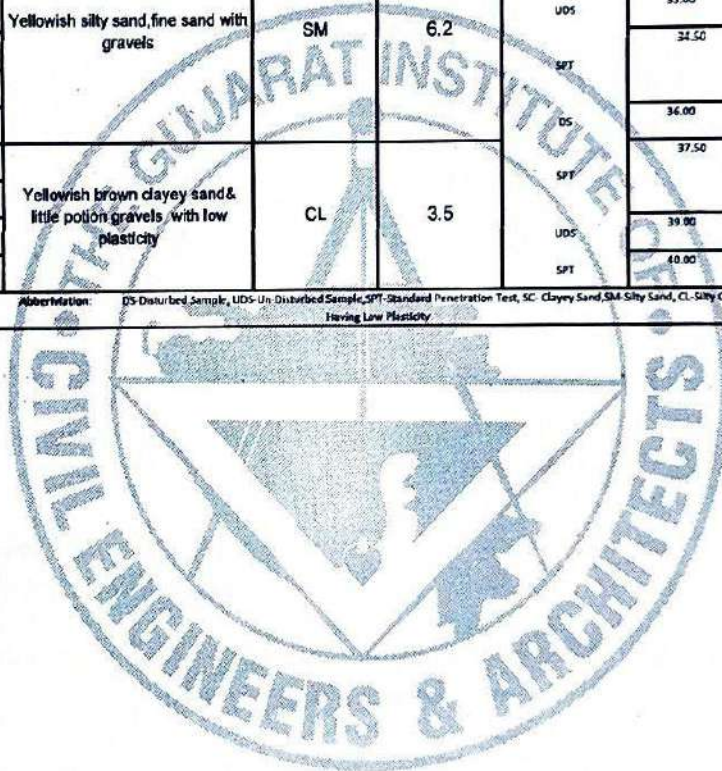
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24.00				UDS	24.00	
25.00				SPT	25.50	37+65>100
26.00				UDS	27.00	
27.00				SPT	28.50	74
28.00	Yellowish reddish brown sand, clay with gravels mix with low plasticity	SC	4.6	UDS	30.00	
29.00				SPT	31.50	36+60/7cm>100
30.00				UDS	33.00	
31.00				SPT	34.50	42+50/6cm>100
32.00				UDS	36.00	
33.00	Yellowish silty sand, fine sand with gravels	SM	6.2	SPT	37.50	64+40/4cm>100
34.00				UDS	39.00	
35.00				SPT	40.00	100/7cm
36.00				UDS		
37.00				SPT		
38.00	Yellowish brown clayey sand & little portion gravels with low plasticity	CL	3.5			
39.00						
40.00						

Abbreviation: DS-Disturbed Sample, UDS-Un Disturbed Sample, SPT-Standard Penetration Test, SC-Clayey Sand, SM-Silty Sand, CL-Silty Clay Having Low Plasticity



ESTD. : 1947



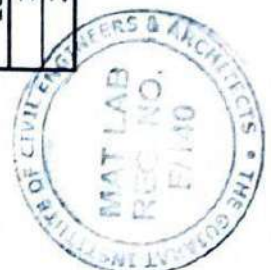
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SOIL CHARACTERISTICS TABLE																		
Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad																		
Ahmedabad Municipal Corporation																		
Project name:		Bore Hole No.:																
Client Name:		Bore Hole Completed on:																
Water Table		30-12-2021																
Not Seen at Drilling Time		30-12-2021																
Depth	Sample Type	SPT-N Value	Insitu Water Content	Density (gm/cc)		Specific Gravity	Particle Size Analysis (%)			Liquid Limit	Plasticity Index	Classification	Type of Shear Test	Cohesion C	Angle of Friction ϕ	Compression Index, C_c	Frees Well	Shrinkage Limit
				%	Bulk		Dry	Gr	Sa									
0.00	DS		3.90				1.7	81.6	16.7	29.53	7.73	SM						
1.50	UDS		7.82	1.71	1.59		0.9	67.1	32	28.98	7.08	SM	TUU					
3.00	SPT	18	9.03				3.2	42.3	54.5	30.65	8.75	CL						
4.50	UDS		15.27	1.85	1.60	2.64	5.7	24.9	68.4	29.47	6.27	ML-CL	TUU	0.1	19.9		22.6	
6.00	SPT	30	11.11				1.3	73.4	25.3	0.00	0.00	SM						
7.50	UDS		9.89	1.85	1.68	2.65	0	56.8	43.2	31.20	11.30	SC	TUU	0.06	28.1			
9.00	SPT	>100	6.38				5.6	69.1	25.3	32.33	12.73	SC						
10.50	UDS		10.80	1.89	1.71	2.66	18.7	45.3	36	30.81	9.41	SC	DUU	0.07	27.5			
12.00	SPT	>100	12.54				8.3	54.1	37.6	0.00	0.00	SM						
13.50	DS		9.89			2.65	7.4	74.5	18.1	0.00	0.00	SM	DUU	0	31.1			
15.00	SPT	>100	10.62				4.3	45.1	50.6	29.72	10.32	CL						
16.5	UDS		9.65	1.95	1.78	2.65	0	17.1	82.9	29.95	10.45	CL	TUU	0.22	15.1			
18	SPT	>100	14.68				0	87.8	12.2	0.00	0.00	SM						
20	SPT	>100	11.94				0	85	15	0.00	0.00	SM						





SPT & DEPTH DESCRIPTION						
Project Name:	Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad					
Client Name:	Ahmedabad Municipal Corporation					
Borehole No	5				Termination Depth :20.00 meter	
Diameter of Boring :	150 mm					
Depth(m)	Description of Sample	SYMBOL/ MATCHING	Thickness of Strata(m)	Sampling Type	Sample Depth (m)	SPT Value Number
0.00	Brownis sand, silt mix with non plasticity	SM	2.60	DS	0	
1.00				UDS	1.50	
2.00						
3.00	Yellowish brown clay,sand& little portion gravels mix with low plasticity	CL	1.50	SPT	3.00	18
4.00				UDS	4.50	
5.00	Yellowish brown clay silt,sand mix with low plasticity	ML-CL	1.20	SPT	6.00	30
6.00						
7.00	Yellowish brown sand ,silt with little portion gravels mix with non plasticity	SM	1.40	UDS	7.50	
8.00						
9.00	Yellowish brown sand ,clay with little portion silt & gravels mix with low plasticity	SC	4.60	SPT	9.00	60
10.00				UDS	10.50	
11.00						
12.00	Yellowish brown sand,sild and littleportion gravels mix with low plasticity	SM	2.90	SPT	12.00	28+70/7CM>100
13.00				DS	13.50	
14.00	Yellowish brown slight reddish clay,sand& little portion gravels mix with low plasticity	CL	3.30	SPT	15.00	100/8CM>100
15.00				UDS	16.50	
16.00						
17.00	Yellowish brown sand,silt mix with non plasticity	SM	2.5	SPT	18.00	38+62/5CM>100
18.00						
19.00				SPT	21.00	47+62/7cm>100
20.00						
Abbreviation: DS-Disturbed Sample, UDS-Un-Disturbed Sample,SPT-Standard Penetration Test, SC- Clayey Sand,SM-Silty Sand, CL-Silty Clay Having Low Plasticity						

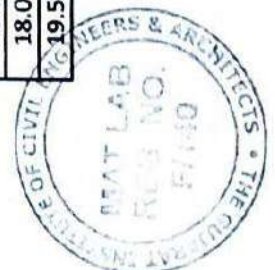


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SOIL CHARACTERISTICS TABLE																			
Project name:		Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi, Gyashpur, Ta. & Dis.: Ahmedabad																	
Client Name:		Ahmedabad Municipal Corporation																	
Water Table		Seen at 19.9mtr Drilling Time																	
Depth	Sample Type	SPT-N Value	Insitu Water Content	Density (gm/cc)		Specific Gravity	Particle Size Analysis (%)			Liquid Limit	Plasticity Index	Classification	Type of Shear Test	Cohesion C (kg/cm²)	Angle of Friction ϕ	Compression Index, Cc	Frees Well	Shrinkage Limit	Bore Hole No.:
mtr.	spt/uds/ds	Nos.	%	Bulk	Dry		Gr	Sn	Silt+ Clay	%	%						%	%	08-01-2022
0.00 DS			1.27				2	64.6	33.4	0.00	0.00	sm							
1.50 UDS			9.29	1.7	1.56		6.6	40.4	53	30.02	10.72	CL							
3.00 SPT		16	7.24			2.64	1.1	42.5	56.4	32.17	11.27	cl							
4.50 UDS			6.67	1.72	1.61		0	39.9	60.1	29.54	8.34	SM							
6.00 SPT		30	4.17			2.65	1.5	50.7	47.8	29.44	9.14	SC							
7.50 UDS			9.59	1.78	1.62		0.6	46.3	53.1	30.23	9.93	SC	DUU	0.08	26.1				
9.00 SPT		44	5.26			2.66	1	65.1	33.9	0.00	0.00	SM							
10.50 UDS			6.76	1.82	1.70		0.9	25.6	73.5	0.00	0.00	SM	DUU	0	30.5				
12.00 SPT		49	9.29			2.65	4.9	55.6	39.5	0.00	0.00	SM							
13.50 UDS			11.52	1.88	1.69		2.5	24.4	73.1	30.65	10.85	CL	TUU	0.17	16.9		21.2		
15.00 SPT		54	5.54			2.66	1.7	39.2	59.1	30.27	9.07	CL							
16.50 DS			9.09	1.9	1.74		10.1	67.4	22.5	28.50	7.90	SM-SC	DUU	0.05	28.1		13.8		
18.00 SPT		>100	25.00				1.1	46.9	52	32.43	12.33	CL							
19.50 UDS			6.95	1.89	1.77		0	36.2	63.8	31.64	11.24	CL	TUU	0.22	13.7				



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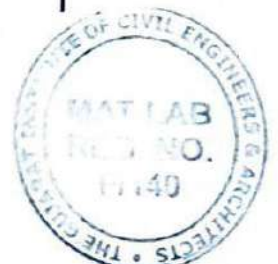
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Depth	Sample Type	In situ Water Content	Density (gm/cc)		Specific Gravity	Particle Size Analysis (%)			Liquid Limit	Plasticity Index	Classification	Type of Shear Test	Cohesion C (kg/cm ²)	Angle of Friction ϕ	Compression Index, Cc	Frees Well	Shrinkage Limit
mtr.	spt/uds/ds	%	Bulk	Dry		Gr	Sn	Silt+ Clay	%	%							%
21.00 SPT	>100	6.67				0	82.4	17.6	0.00	0.00	SM						
22.50 UDS		12.36	1.98	1.76		1.4	53.3	45.3	0.00	0.00	SM	DUU	0	32.3			
24.00 SPT	>100	13.64				0	62	38	0.00	0.00	SM						
25.50 UDS		10.50	2.06	1.86		1.7	53.7	44.6	0.00	0.00	SM	DUU	0	31.9			
27.00 SPT	>100	8.40				3	48.5	48.5	30.02	9.92	SC						
28.50 UDS		6.76	2.01	1.88		3.1	53.2	43.7	30.23	10.73	SC						
30.00 SPT	>100	11.73				0	72.1	27.9	29.98	10.18	SC						
31.50 DS		10.62				1	85.4	13.6	0.00	0.00	SM						
33.00 SPT	>100	11.42				0	76.5	23.5	0.00	0.00	SM						
34.50 UDS		9.89	2.10	1.91		3.1	52	44.9	0.00	0.00	SM						
36.00 SPT	>100	11.11				2.5	85.6	11.9	0.00	0.00	SM						
37.50 UDS		12.18	2.16	1.93		8.7	38.7	52.6	30.18	9.38	CL						
39.00 SPT	>100	12.36				5.6	38.4	56	32.67	12.07	CL						
40.00 SPT	>100	22.22				7	36.7	56.3	31.04	10.54	CL						





SPT & DEPTH DESCRIPTION						
Project Name:	Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad					
Client Name:	Ahmedabad Municipal Corporation					
Borehole No:	6				Termination Depth: 40.00 meter	
Diameter of Boring :	150 mm					
Depth(m)	Description of Sample	SYMBOL/ HARDEN 6	Thickness of Stratum(m)	Sampling Type	Sample Depth (m)	SPT Value Number
0.00	Brownish sand,silt mix with non plasticity	SM	1.00	US	0	
1.00				US	1.50	
2.00	Brownish Clay,sand mix with little portion gravels with low plasticity	CL	3.20	SPT	3.00	16
3.00				US	4.50	
4.00						
5.00	Yellowish brown Sand & silt mix with non plasticity	SM	1.20	SPT	6.00	30
6.00						
7.00	Yellowish brown sand ,silt with little portion clay & gravels mix with low plasticity	SC	3.10	US	2.50	
8.00				SPT	9.00	44
9.00						
10.00	Yellowish brown sand,silt a& little portion gravels with non plasticity	SM	4.30	US	10.50	
11.00				SPT	12.00	49
12.00						
13.00	Yellowish brown Clay,sand mix with little portion gravels with low plasticity	CL	3.7	US	13.50	
14.00				SPT	15.00	54
15.00	Yellowish brown sand,clay,silt mix with very low plasticity	SM-SC	0.8			
16.00				US	16.50	
17.00	Yellowish reddis brown Clay,sand mix with little portion gravels with low plasticity	CL	3.6	SPT	18.00	35+65/8cm>100
18.00				US	19.50	
19.00						
20.00				SPT	21.00	41+50/7cm>100
21.00						



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22.00	Yellowish silty sand, fine sand with gravels	SM	5.8	UDS	22.50	33+54+50/6cm>100
23.00					24.00	
24.00					25.50	
25.00					27.00	
26.00	Yellowish reddish brown sand, clay with gravels mix with low plasticity	SC	4.6	UDS	28.50	29+70/8cm>100
27.00					30.00	
28.00					31.50	
29.00					33.00	
30.00	Yellowish silty sand, fine sand with gravels	SM	5.2	UDS	34.50	58+50/7cm>100
31.00					36.00	
32.00					37.50	
33.00					39.00	
34.00	Yellowish brown clayey sand & little portion gravels with low plasticity	CL	3.5	UDS	40.00	100/10cm>100
35.00						
36.00						
37.00						
38.00				SPT		100/8cm>100
39.00						
40.00						

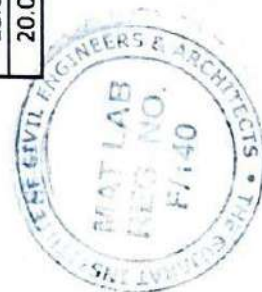
Abbreviation: DS-Disturbed Sample, UDS-Un-Disturbed Sample, SPT-Standard Penetration Test, SC-Clayey Sand, SM-Silty Sand, CL-Silty Clay Having Low Plasticity

ESTD. : 1947





SOIL CHARACTERISTICS TABLE																			
Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad																			
Project name:		Ahmedabad Municipal Corporation														Bore Hole No.:		7	
Client Name:		Ahmedabad Municipal Corporation														Bore Hole Completed on:		31-12-2021	
Water Table		Not Seen at Drilling Time														Bore Hole Completed on:		31-12-2021	
Depth	Sample Type	SPT-N Value	Insitu Water Content	Density (gm/cc)		Specific Gravity	Particle Size Analysis (%)				Liquid Limit	Plasticity Index	Classification	Type of Shear Test	Cohesion C (kg/cm²) (°)	Angle of Friction φ	Compression Index, Cc	Frees Well	Shrinkage Limit
				%	Bulk		Dry	Gr	Sn	Clay									
mtr.	sp/nds/ds	Nos.	%	Bulk	Dry		Gr	Sn	Clay	Silt+	%	%						%	%
0.00 DS			5.54				1.1	62.8	36.1		0.00	0.00	SM						
1.50 SPT		7	9.29				5.1	43.8	51.1		31.93	11.83	CL						
3.00 UDS			10.19	1.77	1.61	2.64	1.7	38.7	59.6		30.50	8.60	CL	TUU	0.15	13	0.09	22.5	
4.50 SPT		40	9.59				2.7	77.7	19.6		30.18	7.58	SC						
6.00 UDS			8.99	1.88	1.72	2.65	7.4	63.6	29		0.00	0.00	SM	DUU	0	29			
7.50 SPT		46	6.38				2.4	54.6	43		31.00	11.90	SC						
9.00 UDS			12.68	1.92	1.70	2.66	0	68.2	31.8		32.23	12.23	SC	DUU	0.13	29			
10.50 SPT	>100		8.99				9.6	59.5	30.9		30.08	8.68	SC						
12.00 DS			8.11			2.66	4.4	78.9	16.7		0.00	0.00	SM	DUU	0	30.8			
13.50 SPT	>100		9.89				3.2	64.2	32.6		0.00	0.00	SC						
15.00 UDS			11.11	2.11	1.90		1	57.7	41.3		30.78	10.68	SC	DUU	0.08	29.3			
16.50 SPT	>100		6.95				0	85.8	14.2		30.13	9.63	SC						
18.00 UDS			13.64	2.14	1.88		0	27.6	72.4		31.60	15.10	CL	TUU	0.23	12.1			
20.00 SPT			11.11				1.2	43.2	55.6		33.00	16.00	CL						



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SPT & DEPTH DESCRIPTION						
Project Name:	Geotechnical Investigation for CONSTRUCTION OF Secured Landfill Phase-2 Project ,Survey NO:337/p Shahwadi,Gyashpur, Ta.& Dis.: Ahmedabad					
Client Name:	Ahmedabad Municipal Corporation					
Borehole No:	7				Penetration Depth : 20.00 meter	
Diameter of Boring :	150 mm					
Depth(m)	Description of Sample	SYMBOL/ NATURAL	Thickness of Strata(m)	Sampling Type	Sample Depth (m)	SPT Value Number
0.00	Brownish sand , silt mix and little portion of Gravels with non plasticity	SM	1.60	DS	0	
1.00				SPT	1.50	7
2.00	Yellowish brown clay,sand and little portion gravels mix with low plasticity	CL	3.10	UDS	3.00	
3.00				SPT	6.50	40
4.00	Yellowish brown sand,silt and little portion gravels mix with non plasticity	SM	1.40	UDS	6.00	
5.00				SPT	7.50	46
6.00	Yellowish brown sand,clay and little portion gravels mix with low plasticity	SC	4.60	UDS	9.00	
7.00				SPT	10.50	31+55+40+4CM>100
8.00	Yellowish brown sand, silt mix with little portion gravels mix with non plasticity	SM	1.10	UDS	12.00	
9.00				SPT	13.50	32+75/10CM>100
10.00	Yellowish brown sand,clay and little portion gravels mix with low plasticity	SC	4.40	UDS	15.00	
11.00				SPT	16.50	65+40/4CM>100
12.00	Yellowish slight reddish brown clay,sand and little portion gravels mix with low plasticity	CL	3.8	SPT	18.00	25+50/2cm>100
13.00				UDS	19.50	
14.00				SPT	21.00	
15.00						
16.00						
17.00						
18.00						
19.00						
20.00						

Abbreviation : DS-Disturbed Sample, UDS-Un Disturbed Sample,SPT-Standard Penetration Test, SC- Clayey Sand,SM Silty Sand, CL Silty Clay
Having Low Plasticity



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SURVEY NO.337/p, MOJE: SHAHWADI, GYASPUR

Permeability Table

Sr. No	BH No.	Depth	Permeability
	Mtr.	Mtr.	Cm/sec
1	1	15	$3.76 * 10^{-6}$
2	2	15	$3.2 * 10^{-6}$
3	3	15	$3.83 * 10^{-6}$
4	4	15	$2.88 * 10^{-6}$
5	5	15	$2.23 * 10^{-6}$
6	6	15	$2.53 * 10^{-6}$
7	7	15	$2.9 * 10^{-6}$

ESTD. : 1947

