ANNEX F Draft Concession Agreement for Varanasi Municipal Corporation

CONCESSION AGREEMENT

This **CONCESSION AGREEMENT** is entered into on this the ___ day of _____, Two Thousand and ____ at Lucknow;

BETWEEN

_____, a municipal corporation constituted under the _____ Act _____, having its principal office at _____ (hereinafter referred to as **"ULB"** which expression shall unless excluded by or repugnant to the context, be deemed to include its administrators, successors and assigns) of One Part;

AND

_____, a company incorporated under the provisions of the Companies Act, 1956, having its registered office at _____ (hereinafter referred to as **"the Concessionaire"** which expression shall unless excluded by or repugnant to the context, be deemed to include its successors, permitted assigns and substitutes) of the Other Part.

WHEREAS:

A. ULB is the urban local body for the city of _____, in the state of Uttar Pradesh, and is responsible for providing municipal and civic services for the benefit of the public residing within its jurisdiction, which includes the collection, segregation, transportation, processing and disposal of Municipal Solid Waste generated within the city.

B. In accordance with the Municipal Solid Wastes (Management and Handling) Rules, 2000 ("**MSW Rules**"), it is mandatory for every Municipal Authority to implement a

scientific municipal solid waste management system wherein Municipal Solid Waste is collected, transported and processed and the remnant waste matter is disposed in accordance with the MSW Rules.

C. In furtherance its objective of improving the solid waste management services in the city of _____, C&DS, UPJN on behalf of ULB has invited private sector participation for design, build, operate, maintain and transfer basis, to undertake door to door collection, segregation, secondary collection, transfer, transportation, processing and disposal of Municipal Solid Waste.

D. C&DS, UPJN had prescribed the technical and commercial terms and conditions (the "Request for Proposals" or "RFP") , and invited bids which term shall include written clarifications issued to the Bidders and written addendum to the Request for Proposal) from the bidders including the {Selected Bidder/ Consortium comprising [_____], [_____] and [_____] (collectively the "**Consortium**") with [__] as its Lead Member}; for implementing the Project;

E. After evaluation of the bids received, the ULB had accepted the bid of the {Selected Bidder / Consortium} and issued its Letter of Award No. [____] dated [____] (hereinafter called the "**LOA**") to the {Selected Bidder / Consortium} requiring, inter alia, the execution of this Concession Agreement;

F. The Selected Bidder / Consortium has since promoted and incorporated the Concessionaire as a limited liability company under the Companies Act 1956 (a special purpose vehicle), and has requested the ULB to accept the Concessionaire as the entity which shall undertake and perform the obligations and exercise the rights of the Selected Bidder/ Consortium under the LOA, including the obligation to enter into this Concession Agreement pursuant to the LOA for executing the Project;

G. By its letter dated [____], the Concessionaire has also joined in the said request of the Selected Bidder / Consortium to the ULB to accept it as the entity which shall undertake and perform the obligations and exercise the rights of the Selected Bidder / Consortium including the obligation to enter into this Concession Agreement pursuant to the LOA. The Concessionaire has further represented to the effect that it has been promoted by the Selected Bidder / Consortium only for the purposes hereof;

H. The Concessionaire has submitted a bank guarantee dated _____ ref No _____ of an amount_____ issued by _____ Bank towards the Performance Security and ULB acknowledges the acceptance of the same;

I. The ULB has agreed to the said request of the {Selected Bidder / Consortium} and the Concessionaire, and has accordingly agreed to enter into this Concession Agreement with the Concessionaire for execution of the Project, subject to and on the terms and conditions set forth hereinafter.

J. The Parties hereto are required to enter into this Concession Agreement, the sufficiency and adequacy of which is hereby acknowledged, and intending to be legally bound, being these presents to record the terms, conditions and covenants of the Concession.

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

ARTICLE 1

DEFINITIONS AND INTERPRETATION

1.1 Definitions

In this Agreement, the following words and expressions shall, unless repugnant to the context or meaning thereof, have the meaning hereinafter respectively ascribed to them hereunder:

"**Accounting Year**" means the financial year commencing from the first day of April of any calendar year and ending on the thirty-first day of March of the next calendar year.

"Affected Party" shall mean the Party claiming to be affected by a Force Majeure Event in accordance with Article 11.

"Agreement" or "Concession Agreement" means this Agreement including its Recitals, Schedules hereto, as of the date hereof and includes any amendments hereto made in accordance with the provisions hereof.

"Applicable Laws" means all laws in force and effect as of the date hereof and which may be promulgated or brought into force and effect by GOI or the GoUP hereinafter in India, including judgments, decrees, injunctions, writs or orders of any court of record, as may be in force and effect during the subsistence of this Agreement and applicable to the Project/Concessionaire.

"Applicable Permits" means all clearances, permits, authorisations, no objection certificates, consents, exemptions and approvals required to be obtained and maintained by the Concessionaire under Applicable Laws, in connection with the Project.

"**Appointed Date**" means the date of handing over of the MSW Processing Site including the Landfill Site as per Article 4 or an earlier date that the Parties may determine;

"Arbitration Act" means the Arbitration and Conciliation Act, 1996 and shall include any amendment to or any re-enactment thereof as in force from time to time.

"**Associate**" means, in relation to the Bidder / Consortium Member, a company who controls or is controlled by such Bidder/ Consortium Member (herein referred to as the "Associate").

As used in this definition, the expression "control" means, with respect to a company, the ownership, directly or indirectly, of 100% (hundred per cent) of the voting shares of such company.

"Awareness Campaign" shall have the meaning ascribed to it in Schedule N.

"Biodegradable Substance" shall have the meaning as ascribed to it under the MSW Rules.

"Bio-Medical Waste" shall have the meaning ascribed to it in the Bio-Medical Waste (Management and Handling) Rules, 1998.

"Book Value" shall mean the cost of the fixed assets incurred and financed by the Concessionaire for the Project, net of accumulated depreciation computed on written down value method in accordance with the rates specified in the Companies Act, 1956 and as determined by an independent firm of chartered accountants mutually agreed upon and appointed by the Parties. For avoidance of doubt, it is clarified that the Book Value shall not include cost of fixed assets funded by Capital Grant given by ULB and the Existing Assets.

"COD" means the commercial operations date of the Project which shall be later of the two dates on which the Construction Supervisor and Independent Engineer have issued the Provisional Completion Certificate or Completion Certificate in accordance with the provisions of Article 6.6(c).

"Completion Certificate" means the certificate issued by Construction Supervisor and Independent Engineer, for their respective scope, certifying, inter alia, that the Concessionaire has developed, constructed or provided all Project Facilities in accordance with this Agreement for implementing the Project.

"Concession" shall have the meaning ascribed thereto in Article 2.2.

"Concession Area" shall have the meaning ascribed thereto in Schedule A.

"Concession Period" shall have the meaning ascribed to in Article 2.3.

"**Consortium**" shall have the meaning set forth in the Recital D.

"**Consortium Member**" means a company specified in Recital D as a member of the Consortium.

"C&DS, UPJN" means the Construction and Design Services, Uttar Pradesh Jal Nigam.

"Construction Period" means the period beginning from the Appointed Date and ending on COD.

"Construction Requirements" shall mean the requirements as to construction / renovation/ up-gradation of the Project Facilities as set out in Schedule F.

"Construction Supervisor" means a Person appointed in accordance with Article 5 for supervising and monitoring compliance by the Concessionaire with the Construction Requirements related to the MSW Processing Facility and Landfill Facility as per the scope of work determined by the ULB/GoUP.

"Construction Works" means all modifications, works and things required to be undertaken by the Concessionaire in accordance with this Agreement.

"Contractor" means any Person with whom the Concessionaire has entered into/may enter into a contract relating to the execution of any works, provision of services and/or operation and maintenance of the Project.

"Cure Period" means the period specified in this Agreement for curing any breach or default of any provision of this Agreement by the Party responsible for such breach or default and shall:

(a) commence from the date on which a notice is delivered by one Party to the other Party asking the latter to cure the breach or default specified in such notice;

(b) not relieve any Party from liability to pay penalty payment or compensation under the provisions of this Agreement; and

(c) not in any way be extended by any period of suspension under this Agreement;

provided that if the cure of any breach by the Concessionaire requires any reasonable action by the Concessionaire that must be approved by the ULB or the Concstruction Supervisor or the Independent Engineer hereunder, the applicable Cure Period shall be extended by the period taken by the ULB or the Concstruction Supervisor or the Independent Engineer to accord their approval.

"**Damages**" shall have the meaning set forth in Article 1.2.

"Development Plan" shall have the meaning ascribed to it in Article 6.4.

"**Dispute**" shall have the meaning set forth in Article 14.

"**Dispute Resolution Procedure**" means the procedure for resolution of Disputes set forth in Article 14.

"Drawings" shall mean all of the drawings, detailed designs, calculations and documents pertaining to the Project in accordance with the Construction Requirements and O&M Requirements.

"**Effective Date**" shall mean the date of signing of this Agreement.

"Emergency" means a condition or situation or event that is likely to endanger the security of individuals on or about the Project Facilities or which poses an immediate threat of material damage to the Project Facilities or which poses a immediate threat to the health and safety of the residents within the Concession Area or which require immediate attention or action by the ULB.

"Encumbrance" means any encumbrance such as mortgage, charge, pledge, lien, hypothecation, security interest, assignment, privilege or priority of any kind having the effect of security or other such obligations and shall include without limitation any designation of loss payees or beneficiaries or any similar arrangement under any insurance policy pertaining to the Project, physical encumbrances and encroachments on the Project Facilities.

"Engineered Sanitary Landfill" shall mean the area within the Landfill Facility, designed with protective measures against pollution of ground water, surface water and air fugitive dust, windblown litter, bad odor, fire hazard, bird menace, pests or rodents, greenhouse gas emissions, slope instability and erosion, and utilitised for disposal of Landfill Waste.

"**Escrow Account**" means and includes an Account which the Concessionaire shall open and maintain with a bank in which all inflows and outflows of cash on account of User Charges shall be credited and debited, as the case may be, in accordance with the provisions of this Agreement, and includes the sub-accounts of such Escrow Account;

"Event of Default" shall have the meaning ascribed there to in Article 12.

"**Existing Assets"** shall mean collectively the assets of the ULB including the Project Site, movable assets (vehicles and equipments) set out in Schedule D.

"**Financial Proposal"** shall mean the financial offer given by the Concessionaire in response to the RFP released for the Project.

"**Financial Year**" shall mean the period commencing from April 1 of any given year to March 31 of the succeeding year.

"Fit for Landfilling" shall have the meaning ascribed to it in Schedule G.

"**Force Majuere"** or **"Force Majeure Event"** shall have the meaning ascribed thereto in Article 11.

"Good Industry Practice" means the exercise of that degree of skill, diligence, prudence and foresight in compliance with the undertakings and obligations under this Agreement which would reasonably and ordinarily be expected from a skilled and experienced Person engaged in the implementation, operation and maintenance or supervision or monitoring thereof or any of them of a project of the type similar to that of the Project.

"GoI" means the Government of India.

"GoUP" means the Government of Uttar Pradesh.

"Government Agency" means GoI, GoUP, ULB or any state government or governmental department, commission, board, body, bureau, agency, authority, instrumentality, administrative body, central, state, or local, having jurisdiction over the Concessionaire, Concession Area, Project, or any part thereof, or the performance of all or any of the services or obligations of the Concessionaire under or pursuant to this Agreement.

"Handback Requirements" shall have the meaning ascribed thereto in Article 13.

"Hazardous Wastes" shall have the meaning ascribed to it in the Hazardous Wastes (Management and Handling) Rules, 1989.

"**Incoming Waste**" shall have the meaning ascribed to it in Article 6.17.

"Independent Engineer" means a reputed Person being a firm, company or a body corporate appointed in accordance with Article 5 for supervising and monitoring compliance by the Concessionaire with the Construction Requirements and O&M Requirements, more particularly to undertake, perform, carry out the duties, responsibilities, services and activities has set forth in Schedule I.

"**Insurance Cover**" means the aggregate of the maximum sums insured under the insurances taken out by the Concessionaire pursuant to Article 6.14 and when used in the context of any act or event, it shall mean the aggregate of the maximum sums insured and payable in relation to such act or event;

"Landfilling" shall mean disposal of the Landfill Waste in the Engineered Sanitary Landfill in accordance with the terms of this Agreement.

"Landfill Facility" means the Engineered Sanitary Landfill and associated facilities duly designed, build and commissioned by the Concessionaire in accordance with the provisions of the Agreement.

"Landfill Life" shall mean the period commencing from COD and expiring upon completion of activities as per O&M Requirements when the Engineered Sanitary Landfill is fully filled with Landfill Waste and a final cover designed in accordance with the MSW Rules is laid on the Engineered Sanitary Landfill and in accordance with the provisions of this Agreement.

"Landfill Site" shall mean part of the MSW Processing Site excluding the area on which MSW Processing Facility is located.

"Landfill Waste" shall mean the Residual Inert Matter, duly certified as Fit for Landfilling by the Independent Engineer in accordance with the O&M Requirements.

"MSW Processing Facility" shall mean the facilities for processing Municipal Solid Waste designed, build and commissioned by the Concessionaire in accordance with the provisions of the Agreement.

"**MSW Processing Site**" means the area of land measuring _____ acres located at _____ (as described in Schedule C) where the MSW Processing Facility and Landfill Facility are to be located and handed over to the Concessionaire by ULB for the purpose of implementation of the Project.

"**Management Control**" means the possession, directly or indirectly of the power to direct or cause the direction of the management and policies of the Concessionaire, whether through the ownership of voting securities, by contract or otherwise or the power to elect or appoint more than 50% (fifty percent) of the directors or other individuals exercising similar authority with respect to the Concessionaire.

"Material Adverse Effect" means a material adverse effect on (a) the ability of the Concessionaire to exercise any of its rights or perform/discharge any of its duties/obligations under and in accordance with the provisions of this Agreement and/or (b) the legality, validity, binding nature or enforceability of this Agreement.

"Material Breach" means a breach by either Party of any of its obligations under this Agreement which has or is likely to have a Material Adverse Effect on the Project and which such Party shall have failed to cure.

"Municipal Solid Waste" or "MSW" shall have the meaning ascribed thereto in the MSW Rules.

"MSW Rules" shall mean the Municipal Solid Wastes (Management and Handling) Rules, 2000 and includes any amendment thereto as in force.

"New Assets" shall mean collectively the assets set out in Schedule E, to be provided/ procured/ constructed by the Concessionaire for implementing the Project.

"Non-Biodegradable Substance" shall mean all substances including packaging material, metal, inerts, plastic, drain silt, street sweeping waste, clothing, rubber and paper products excluding Bio-degradable Substance, construction debris, Hazardous Wastes and Biomedical Waste.

"O&M Requirements" means the requirements as to operation and maintenance of the Project set forth in Schedule G.

"Operations Period" means the period commencing from COD and ending at the expiry or Termination of the Concession Agreement.

"Parties" means the parties to this Agreement and **"Party"** means either of them, as the context may admit or require.

"Performance Security" means the guarantee for performance of its obligations to be procured by the Concessionaire in accordance with Article 6.1.

"Person" means (unless otherwise specified or required by the context), any individual, company, corporation, partnership, joint venture, trust, unincorporated organisation, government or Government Agency or any other legal entity.

"Post Closure Maintenance Plan" shall have the meaning ascribed thereto in Article 6.26.

"Post Closure Activities" shall mean the activities to be undertaken by the Concessionaire during the Post Closure Period in accordance with the provisions of **Schedule G**.

"Post Closure Period" shall mean the period commencing from the day immediately following the expiry of Landfill Life of the particular cell and ending on the fifteenth anniversary of the said day.

"Preliminary Notice" means the notice of intended Termination by the Party entitled to terminate this Agreement to the other Party setting out, inter alia, the underlying Event of Default.

"Processing" shall mean process by which MSW is transformed into new or recycled products including processes like composting, pelletisation or any other appropriate processes in accordance with relevant Applicable Laws.

"Project" shall mean the door to door collection, segregation, secondary collection, transfer, transportation, delivery of MSW at MSW Processing Facility, processing of MSW, dumping of Landfill Waste to Landfill Facility and design, financing, procurement, construction, operation, maintenance and management of the Project Facilities in accordance with the provisions of this Agreement.

"Project Facilities" shall mean the MSW Processing Facility, Landfill Facility together with the Existing Assets, the New Assets and all other related facilities located thereon, and any other offsite facilities created for the Project.

"Project Site" collectively means the MSW Processing Site, Landfill Site Workshop Site and land for transfer station/ any other part of the Project Facilities to be provided by ULB.

"Provisional Completion Certificate" means the Completion Certificate issued by Construction Supervisor and Independent Engineer pending completion of the Punch List items in accordance with Article 6.6.

"Punch List" shall have the meaning ascribed thereto in Article 6.6(c).

"**Request for Proposals**" or "RFP" shall have the meaning set forth in Recital D;

"**Residual Inert Matter"** shall mean the material left as residue after Processing of Municipal Solid Waste and segregation and removal of the organic matter, compost or organic manure therefrom, either wholly or in part, and includes pre-processing rejects.

"**Right of Way**" means the constructive possession of the Project Site, together with all way leaves, easements, unrestricted access and other rights of way, howsoever described, necessary for implementation of the Project in accordance with this Agreement;

"Rupees" or "Rs." refers to the lawful currency of the Republic of India.

"**SBI PLR**" means the prime lending rate of the State Bank of India prevailing as on the date of a payment due from which the computation of interest is required to be made under the Agreement;

"Scheduled Project Completion Date" means 8 (eight) calendar months from the Appointed Date including any extension thereof provided by the ULB.

"**Statutory Auditors**" means a reputed firm of chartered accountants acting as the statutory auditors of the Concessionaire under the provisions of the Companies Act, 1956 including any statutory modification or re-enactment thereof, for the time being in force;

"Taxes" means any Indian taxes including excise duties, customs duties, value added tax, sales tax, local taxes, cess and any impost or surcharge of like nature (whether Central, State or local) on the goods, materials, equipment and services incorporated in and forming part of the Project charged, levied or imposed by any Government instrumentality, but excluding any interest, penalties and other sums in relation thereto imposed on any account whatsoever. For the avoidance of doubt, Taxes shall not include taxes on corporate income;

"Termination" means termination of this Agreement pursuant to Termination Notice or otherwise in accordance with the provisions of this Agreement but shall not, unless the context otherwise requires, include the expiry of this Agreement due to efflux of time in the normal course.

"Termination Date" means the date specified in the Termination Notice as the date on which Termination occurs.

"Termination Notice" means the notice of Termination by either Party to the other Party, in accordance with the applicable provisions of this Agreement.

"Tests" means the tests to be carried out in accordance with the Construction Requirements or O&M Requirements and "Testing" and "Tested" shall be construed accordingly.

"Tipping Fee" means the amount payable by ULB to the Concessionaire in accordance with Article 10.

"User Charges" means the charges/ fees payable by the generators of the MSW in accordance with the notification issued by the ULB.

"Vehicle Tracking and Monitoring System" shall mean the hardware and software of the equipment/ technology required to track the movement of vehicles carrying MSW.

"Workshop Site" shall mean the land described in Schedule B provided by ULB to the Concessionaire for the purpose of parking, repairing and refueling of vehicles used by the Concessionaire during the Operations Period.

1.2 Interpretation

In this Agreement, unless the context otherwise requires,

a. any reference to a statutory provision shall include such provision as is from time to time modified or re-enacted or consolidated so far as such modification or re-enactment or consolidation applies to, or is capable of being applied to any transactions entered into hereunder;

b. references to Applicable Laws shall include the laws, acts, ordinances, rules, regulations, notifications, guidelines or bylaws which have the force of law;

c. the words importing singular shall include plural and vice versa, and words denoting natural persons shall include partnerships, firms, companies, corporations, joint ventures, trusts, associations, organisations or other entities (whether or not having a separate legal entity);

d. the headings are for convenience of reference only and shall not be used in, and shall not affect, the construction or interpretation of this Agreement;

e. the words "include" and "including" are to be construed without limitation;

f. any reference to day, month or year shall mean a reference to a calendar day, calendar month or calendar year respectively;

g. the Schedules to this Agreement form an integral part of this Agreement as though they were expressly set out in the body of this Agreement;

h. any reference at any time to any agreement, deed, instrument, license or document of any description shall be construed as reference to that agreement, deed, instrument, license or other document as amended, varied, supplemented, modified or suspended at the time of such reference;

i. references to Recitals, Articles, Sub-articles, or Schedules in this Agreement shall, except where the context otherwise requires, be deemed to be references to Recitals, Articles, Sub-articles, and Schedules of or to this Agreement;

j. any agreement, consent, approval, authorisation, notice, communication, information or report required under or pursuant to this Agreement from or by any Party shall be valid and effectual only if it is in writing under the hands of duly authorized representative of such Party in this behalf and not otherwise;

k. any reference to any period commencing "from" a specified day or date and "till" or "until" a specified day or date shall include both such days or dates;

l. the damages payable by either Party to the other of them, as set forth in this Agreement, whether on per diem basis or otherwise, are mutually agreed genuine pre-estimated loss and damage likely to be suffered and incurred by the Party entitled to receive the same and are not by way of penalty (the "**Damages**").

1.3 Priority of agreements and errors/discrepancies

1.3.1 This Agreement, and all other agreements and documents forming part of this agreement are to be taken as mutually explanatory and, unless otherwise expressly provided elsewhere in this Agreement, the priority of this Agreement and other documents forming part hereof shall, in the event of any conflict or inconsistency between them, be in the following order:

(a) this Agreement;
(b) all documents forming part hereof;

i.e., the Agreement at (a) above shall prevail over documents at (b) above.

1.3.2 Subject to the provisions of Article [1.3.1], in case of ambiguities or discrepancies within this Agreement, the following shall apply:

(a) between two or more Articles of this Agreement, the provisions of a specific Article relevant to the issue under consideration shall prevail over those in other Articles;
(b) between the Articles of this Agreement and the Schedules, the Articles shall prevail and between Schedules and Annexures, the Schedules shall prevail;
(c) between any two Schedules, the Schedule relevant to the issue shall prevail;
(d) between the dimension scaled from the drawing and its specific written dimension, the latter shall prevail; and
(e) between any value written in numerals and in words, the latter shall prevail.

ARTICLE 2

CONCESSION

2.1 Scope of Work for the Project

The scope of work of the Project (the "**Scope of Work for the Project**") shall mean and include the provision of the following services and facilities within the Concession Area, during the Concession Period by the Concessionaire:

(a) Door-to-door collection of MSW;
(b) Primary storage of collected door-to-door MSW;
(c) Secondary collection and transportation of MSW including street sweeping waste, drain silt;
(d) Development, construction and operation & maintenance of the MSW Processing Facility with composting as one of the main processes including segregation;
(e) Development, construction and operation and maintenance of the Landfill Facility;
(f) Post Closure Activities of Landfill Facility;
(g) Collection, transportation, processing and disposal of the MSW littered within the Concession Area as on COD;
(h) Assist ULB in public education / Awareness Campaign related to MSW;
(i) Collection of the User Charges, on behalf of ULB as determined by the ULB from time to time;
(j) Develop and implement a Complaint Redressal system
(k) Development, financing, operation and maintenance of the Project
(l) Augmentation of equipment/ vehicles, capacity enhancement and provision of ancillary facilities required for implementation of the Project during the Concession Period.
(m) Deployment of adequate and qualified manpower for construction, operation and maintenance management of the Project;
(n) Procure and/or provide any other required support services and facilities required for the Project; and
(o) Performance and fulfilment of all the obligations of the Concessionaire in accordance to the provisions of this Agreement and matters incidental thereto or necessary for the performance of any or all of the obligations of the Concessionaire under this Agreement.

During the Concession Period, the Concessionaire shall ensure that all MSW generated within the Concession Area is collected, transported, segregated, processed and disposed in accordance with Applicable Laws and in accordance with this Agreement.

2.2 Grant of Concession

Subject to and in accordance with the terms, conditions and covenants set forth in this Agreement the Applicable Laws and the Applicable Permits, theULB hereby grants and authorises the Concessionaire to

(i) undertake door to door collection of Municipal Solid Waste from Persons generating such waste within the Concession Area;
(ii) collect Municipal Solid Waste from the street corner bins within the Concession Area, in accordance with Applicable Laws;
(iii) transfer, transport and deliver MSW at the MSW Processing Site either directly or through transfer station;
(iv) process the MSW brought to the MSW Processing Site and dump the Landfill Waste to the Landfill Facility;
(v) design, engineer, procure, finance, modify, construct, operate, maintain and transfer the Project Facilities; and
(vi) exercise and/or enjoy the rights, powers, benefits, privileges, authorisations and entitlements as set forth in this Agreement

(hereinafter collectively referred to as "**the Concession**").

2.3 Concession Period

The Concession hereby granted is for (i) Construction Period and (ii) a period of 30 (thirty) years from the COD or until earlier termination thereof in accordance with the terms of this Agreement (**"Concession Period"**).

Provided that in the event of Termination, the Concession Period shall mean and be limited to the period commencing from the Appointed Date and ending with the Termination Date.

2.4 Exclusivity of the Concession

The Concessionaire shall be the sole and exclusive person entitled to undertake the Project in the Concession Area and ULB agrees that no agreement or arrangement permitting the activities as per the Scope of Work for the Project covered under this Agreement by any other party shall be entered into by ULB during the Concession Period.

2.5 Acceptance of the Concession

In consideration of the rights, privileges and benefits conferred upon the Concessionaire by ULB and other good and valuable consideration expressed herein, the Concessionaire hereby accepts the Concession and agrees and undertakes to implement the Project and perform/discharge all its obligations in accordance with the provisions hereof.

ARTICLE 3

Not used

ARTICLE 4

HANDOVER OF EXISTING ASSETS

4.1 Handover of Existing Assets

(a) ULB shall within a period of 30 (thirty) days from the Effective Date or any mutually agreed date, allow necessary access and handover vacant and peaceful physical possession to the Concessionaire of the MSW Processing Site including Landfill Site, free from Encumbrance, for enabling the Concessionaire to carry out construction, renovation, upgradation, or modifications thereto in accordance with the Construction Requirements, for the purpose of implementing the Project.

(b) Upon the Concessionaire being granted access to the MSW Processing Site pursuant to the preceding Sub-article (a), the Concessionaire shall, subject to the provisions of Article 6, have the right to enter upon and renovate, construct or modify the same at its own costs in accordance with the Construction Requirements and carry out such investigations, development and improvements to the MSW Processing Site and arrange for procuring and providing the New Assets, as may be necessary or appropriate to implement the Project in accordance with the provisions of this Agreement.

The Concessionaire shall in consultation with the ULB/ Independent Engineer prepare an implementation plan for the parts of the Existing Assets which are required to be used/ accessed by the ULB during the Construction Period and require access by the Concessionaire for fulfilling its obligations under this Agreement.

(c) The ULB shall, upon achievement of COD, handover peaceful physical possession to the Concessionaire of the balance Existing Assets, free from Encumbrance, for enabling the Concessionaire to carry out its responsibilities under this Agreement.

(d) In case, any part/ component of the Existing Assets become non-operable/ redundant/ useless during the Operations Period, then it shall be handed back to the ULB, without any Encumbrance, within 30 (thirty) days of such event thereafter such part/ component shall cease to be part of the Existing Assets

and accordingly the Concessionaire's responsibilities/ obligations shall cease to exist in this regard.

4.2 Rights, Title and Use of Project Facilities

(a) The Concessionaire shall have the right to use the Project Facilities in accordance with the provisions of this Agreement and for this purpose, it may regulate the entry into or use of the same by third parties.

Provided that ULB shall have the right to put up advertisements on the Project Facilities and retain any and all revenue generated from such activity. The Concessionaire shall provide full support/ cooperation to the ULB in the same.

For avoidance of doubt, it is clarified that the Concessionaire shall have no rights to display any advertisement on the Project Facilities or part thereof.

(b) The Project Facilities are and shall continue to be the property of ULB.

(c) The Concessionaire shall not part with or create any Encumbrance on the part of the Project Facilities including the Project Site, save and except as set forth and permitted under this Agreement.

(d) The Concessionaire shall not be allowed to use the Project Facilities for any purpose other than for the purpose of the Project and purposes incidental or ancillary thereto.

(e) The Concessionaire shall allow access to and use of the Project Site for laying/ installing/ maintaining telegraph lines, electric lines or for such other public purposes as ULB may specify / require from time to time.

Provided that such access or use shall not result in a Material Adverse Effect and that ULB shall, in the event of any physical damage to the Project Facilities on account thereof, ensure that the Project Facilities are promptly restored at its own cost and expenses.

Provided further, that to the extent such access and use allowed by the Concessionaire affects the performance of any of its obligations hereunder, the Concessionaire shall not be deemed or construed to be in breach of its obligations nor shall it incur/suffer any liability on account thereof.

4.3 Peaceful Possession

ULB hereby represents and warrants that:

(a) The Project Site
(i) have been acquired through the due process of law; or

(ii) belongs to or has been leased to or is vested in ULB,

and that ULB has full powers to hold, dispose of and deal with the same consistent, inter-alia, with the provisions of this Agreement and that the Concessionaire shall, have no liability regarding any compensation payment on account of land acquisition or rehabilitation/resettlement of any Persons affected directly and/or indirectly thereby.

(b) The Concessionaire shall, subject to complying with the terms and conditions of this Agreement, remain in peaceful possession and enjoyment of the Existing Assets during the Concession Period. In the event the Concessionaire is obstructed by any Person claiming any right, title or interest in or over the Existing Assets or any part thereof or in the event of any enforcement action including any attachment, distraint, appointment of receiver or liquidator being initiated by any Person claiming to have any interest in/charge on the Existing Assets or any part thereof, the ULB shall, if called upon by the Concessionaire, defend such claims and proceedings and also keep the Concessionaire indemnified against any consequential loss or damages which the Concessionaire may suffer, on account of any such right, title, interest or charge.

ARTICLE 5

CONSTRUCTION SUPERVISOR AND INDEPENDENT ENGINEER

5.1 Construction Supervisor and Independent Engineer

(a) The Construction Supervisor and Independent Engineer shall be appointed for the Project by the ULB.

(b) The role of the Construction Supervisor shall be as determined by ULB/ GoUP at the time of its appointment and that of Independent Engineer has been detailed in Schedule I. Their respective scope are briefly decribed below :

Scope of Construction Supervisor	Scope of Independent Engineer
Review/ oversee the design and supervision of construction of the MSW Processing Facility and Landfill Facility until 6 (six) months after the COD.	Review/ oversee/ supervision of the (i) design and construction works of Project Facilities except for the activities covered in the scope of Construction Supervisor; and (ii) operations and maintenance of the Project.

(c) In case the Construction Supervisor is not appointed by ULB / GoUP, ULB may include the above scope of work as carried out by the Construction

Supervisor in the role of Independent Engineer and such work shall accordingly be carried out by the Independent Engineer.

5.2 Construction Supervisor

(a) ULB, in consultation with GoUP, can appoint any Person as the Construction Supervisor for the Project.

(b) The initial term of appointment of the Construction Supervisor shall be limited to the period commencing from the Appointed Date until 6 (six) months after the COD.

(c) All fees, costs, charges and expenses payable to the Construction Supervisor in accordance with the terms of its appointment shall be borne by the ULB/GoUP. It is clarified that the Concessionaire shall not be responsible for any fees, costs, charges and expenses payable to the Construction Supervisor.

5.3 Procedure for Appointment of Independent Engineer

(a) ULB shall appoint an Independent Engineer on a fulltime basis for the Project. ULB shall endeavour to complete the process of appointment of the Independent Engineer within 30 (thirty) days from the Appointed Date.

(b) The initial term of the Independent Engineer may extend upto 3 (three) years. On expiry or termination of the aforesaid term, the ULB may in its discretion renew the appointment, or appoint another firm to be the Independent Engineer for another term of 3 (three) years, and such procedure shall be repeated after expiry of each appointment for the duration of the Concession Period

5.4 Payments to Independent Engineer

All fees, costs, charges and expenses payable to the Independent Engineer in accordance with the terms of its appointment (collectively "**the Remuneration**") shall be borne by the ULB.

5.5 Site Office for Independent Engineer and Construction Supervisor

The Concessionaire shall, during the Concession Period provide and maintain a reasonably furnished site office accommodation for the Independent Engineer/and Construction Supervisor, at the MSW Processing Site. Such a site office shall have work stations including heating and cooling equipment and toilet facilities. All expenses / charges in respect of maintenance of the site office, electricity and power charges shall be borne by the Concessionaire.

ARTICLE 6

CONCESSIONAIRE'S OBLIGATIONS

In addition to and not in derogation or substitution of any of its other obligations under this Agreement, the Concessionaire shall have the following obligations:

6.1. Performance Security

(a) The Concessionaire shall, for the due and punctual performance of its obligations relating to the Project, deliver to the ULB, prior to / simultaneous with the execution of this Agreement, a bank guarantee substantially in the format provided in the Schedule L from a nationalized bank / State Bank of India or any of its subsidiaries (other than regional rural banks and cooperative banks) , ("Performance Security") for a sum of Rs. 530 lakhs (Rupees five crore and thirty lakhs only)[1] valid initially for a period of 24 (twenty four) months from the Effective Date.

(b) The Performance Security shall be kept valid by the Concessionaire throughout the Concession Period by renewal or otherwise.

(c) Subsequent to the completion of 1 (one) calendar year from the COD, the Concessionaire shall submit an additional Performance Security by way of a Bank Guarantee, issued by a nationalized bank / State Bank of India or any of its subsidiaries (other than regional rural banks and cooperative banks) of an amount equivalent to the 10% of the total Tipping Fee payable to the Concessionaire during the immediately preceding calendar year. The amount of the additional Performance Security shall be computed on an annual basis and kept valid by the Concessionaire throughout the Concession Period by renewal or otherwise. This additional Performance Security shall be submitted to the ULB within 30 days of the commencement of each operations and maintenance year.

Provided that if the Agreement is terminated due to any event other than a Concessionaire Event of Default, the Performance Security if subsisting as of the Termination Date shall, subject to ULB's right to receive or recover amounts, if any, due from the Concessionaire under this Agreement, be duly discharged and released to the Concessionaire.

[1] In case the Concessionaire is the Selected Bidder for more than three towns (out of Mathura, Jhansi, Aligarh, Gorakhpur, Moradabad, Allahabad, Meerut, Varanasi and Lucknow), the mentioned Performance Security shall be increased by 50%. In case selection of Selected Bidder for more than 3 towns occurs after the Effective Date, then the Concessionaire shall submit the additional amount of the Performance Security i.e. 50% of the original Performance Security, within 30 days of such selection.

(d) In case, the Performance Security has been invoked in part or full in accordance with the terms of this Agreement, the Concessionaire undertakes to forthwith furnish a top up guarantee or replenish the Performance Security in the manner such that the aggregate value of the performance guarantee equals the original value of Performance Security at the time of Effective Date and additional Performance Security.

6.2. **Applicable Permits**

The Concessionaire shall in respect of the Project, procure the Applicable Permits and be in compliance thereof at all times during the Concession Period.

C&DS, UPJN on behalf of ULB has already approached Uttar Pradesh Pollution Control Board, for obtaining the clearance for implementation of the Project. It is however clarified that the Concessionaire shall be solely responsible for obtaining such clearances.

6.3. Financing Arrangement

The Concessionaire shall at its cost, expenses and risk make all such financing arrangements as would be necessary to implement the Project and to meet all of its obligations under this Agreement, in a timely manner.

6.4. Development Plan

(i) The Concessionaire shall within 15 (fifteen) days of the Appointed Date, submit to the Construction Supervisor, Independent Engineer and ULB a plan ("**the Development Plan**") in conformity with the Construction Requirements, O&M Requirements and business plan submitted by the Selected Bidder along with the Financial Proposal.

(ii) Within 7 (seven) days of receipt of the Development Plan, the Construction Supervisor and Independent Engineer shall review the relevant parts taking into account, inter-alia, comments of the ULB, if any, thereon, and convey their comments/ observations to the Concessionaire on the Development Plan, including the need, if any, to modify the same. If the comments/ observations of the Construction Supervisor and Independent Engineer require the Development Plan to be modified, the Concessionaire shall suitably modify the Development Plan and re-submit to Construction Supervisor and/or Independent Engineer, as the case may be for further review. The Construction Supervisor and Independent Engineer shall give their observations and comments, if any, within 7 (seven) days of receipt of such revised Development Plan, which shall be taken into account by the Concessionaire while finalising the Development Plan.

(iii) If, within the period stipulated in the preceding Sub-article (ii), the Construction Supervisor and Independent Engineer does not respond to the Development Plan submitted to it by the Concessionaire, the Concessionaire shall be entitled to proceed with the Project on the basis of the Development Plan submitted by it to the Construction Supervisor and Independent Engineer.

(iv) Notwithstanding any review or failure to review by the Concessionaire or the comments/observations of the Construction Supervisor and/or Independent Engineer or the ULB, the Concessionaire shall be solely responsible for the adequacy of the Development Plan and the conformity thereof with the Construction Requirements and shall not be relieved or absolved in any manner whatsoever of any of its obligations hereunder.

6.5. Drawings

(a) Preparation of Drawings

(i) The Concessionaire, subject to the Construction Requirements, shall prepare its own Drawings.

(ii) The Drawings shall be subject to review by the Construction Supervisor and Independent Engineer as hereinafter provided in Sub-article (b).

(b) Review of Drawings

(i) The Concessionaire shall within 30 (thirty) days from the Appointed Date and in such sequence as is consistent with the Construction Requirements, submit a copy of each of the Drawings to the Construction Supervisor, Independent Engineer and ULB.

(ii) By forwarding a copy of the Drawings to the Construction Supervisor/ Independent Engineer and ULB pursuant to the preceding Sub-article (i), the Concessionaire shall be deemed to have represented that it has verified and determined that the Drawings forwarded are in conformity with the Construction Requirements.

(iii) Within 15(fifteen) days of receipt of the Drawings, Construction Supervisor/ Independent Engineer shall review the same with respect to their scope of work, taking into account, interalia, comments of ULB, if any, thereon, and convey their comments/ observations to the Concessionaire on the conformity of Drawings with Construction Requirements. If the comments/observations of the Construction Supervisor/ Independent Engineer indicate that the Drawings are not in conformity with the Construction Requirements, such Drawings shall be revised by the Concessionaire to the extent necessary and resubmitted to Construction Supervisor/ Independent Engineer for further review. The Construction Supervisor/ Independent Engineer shall give their

observations and comments, if any, within 15 (fifteen) days of receipt of such revised Drawings, which shall be taken into account by the Concessionaire while finalising the Drawings.

(iv) If, within the period stipulated in the preceding Sub-article (iii), the Construction Supervisor/ Independent Engineer does not respond to the Drawings submitted to it by the Concessionaire the Concessionaire shall be entitled to proceed with the Project on the basis of such Drawings submitted by it to the Construction Supervisor/ Independent Engineer, and intimate the same to ULB. The same should be highlighted in the periodic reporting by the Concessionaire.

(v) Notwithstanding any review or failure to review by or the comments / observations of the Construction Supervisor or Independent Engineer or the ULB, the Concessionaire shall be solely responsible for the adequacy of the Drawings and their conformity with the Construction Requirements, and shall not be relieved or absolved in any manner whatsoever of any of its obligations hereunder.

(vi) The Concessionaire shall be responsible for delays in meeting the Construction Requirements caused by reason of any Drawings not being in conformity with the Construction Requirements, and shall not be entitled to seek any relief in that regard from ULB.

(vii) The Concessionaire shall in consultation with the Construction Supervisor/ Independent Engineer finalise an implementation schedule for their respective scope.

6.6. Project Implementation

(a) New Assets

The Concessionaire shall procure/ provide the New Assets in accordance with the Development Plan and Construction Requirements and operate & maintain them during the Operations Period in accordance with the O&M Requirements.

(b) Construction Works

(i) No Construction Works shall begin until the Construction Supervisor/ Independent Engineer is in place and has assumed charge.

(ii) The Concessionaire shall adhere to the Construction Requirements and achieve COD on or before the Scheduled Project Completion Date.

Provided that, on the written request by the Concessionaire for extension of Scheduled Project Completion Date due to reasons solely attributable to the

Concessionaire, ULB may consider such a request, subject to the Concessionaire agreeing to pay an amount of Rs. 5.00 lakh per week of extension as liquidated damages. However, such extension shall in no case exceed six months from Scheduled Project Completion Date. In the event Concessionaire is not able to achieve COD within such extended period, it shall be treated as a Concessionaire Event of Default.

(iii) The Concessionaire may undertake Construction Works by itself or through a Contractor possessing requisite technical, financial and managerial expertise/ capability; but in either case, the Concessionaire shall remain solely responsible to meet the Construction Requirements.

Prior to commencement of construction, renovation/ repair of any of the Project Facilities, the Concessionaire shall have obtained all such Applicable Permits as are necessary to commence construction/ renovation/ repair of such facilities.

(iv) The Concessionaire shall, during the Construction Period be well organized and designate and appoint suitable officers/ representatives as it may deem appropriate to supervise the Project, to deal with the Construction Supervisor/ Independent Engineer / ULB and to be responsible for all necessary exchange of information required pursuant to this Agreement;

(c) Completion Certificate and Provisional Completion Certificate

i. The Concessionaire shall carry out all necessary and periodical Tests under the supervision of the Construction Supervisor/ Independent Engineer as the case may be, for the purposes of determining that the New Assets purchased/ constructed and Construction Works respectively are being undertaken in accordance with the Construction Requirements. The Concessionaire shall maintain proper record of such Tests and the remedial measures taken to cure the defects or deficiencies, if any, indicated by the Test results.

ii. If the Tests are successful and the Project Facilities can be safely and reliably operated, the Construction Supervisor shall issue Completion Certificate for MSW Processing Facility and Landfill Facility and Independent Engineer shall issue Completion Certificate for the balance part of the Project Facilities.

Provided, notwithstanding that certain works or things forming part of Construction Works are not complete, if following Tests, the Construction Supervisor determines that the MSW Processing Facility and Landfill Facility or Independent Engineer determines that the balance part of the Project Facilities, as the case may be can be safely and reliably operated, the Construction Supervisor or Independent Engineer, as the case may be, may issue Provisional Completion Certificate for them to the Concessionaire. The Provisional Completion Certificate shall have appended thereto a list of

outstanding items ("**Punch List**"). All Punch List items shall be completed by the Concessionaire within such time as may be determined by the Construction Supervisor or Independent Engineer, as the case may be, not exceeding 3 (three) weeks of the date of issue of the Provisional Completion Certificate. Upon satisfactory completion of all Punch List items, the Construction Supervisor or Independent Engineer, as the case may be, shall promptly and in any case within 7 (seven) days thereof, issue Completion Certificate.

iii. If the Concessionaire fails to complete the Punch List items within the said period of 3 (three) weeks, the ULB may, without prejudice to any other rights or remedy available to it under this Agreement, have such items completed at the risk and costs of the Concessionaire. The cost incurred by ULB in completing the Punch List items, as certified by the Construction Supervisor or Independent Engineer, as the case may be, shall be reimbursed by the Concessionaire to ULB within 7 (seven) days from the date of receipt of a claim in respect thereof from ULB. Thereupon, the Construction Supervisor or Independent Engineer, as the case may be, may issue Completion Certificate.

iv. The Construction Supervisor or Independent Engineer, as the case may be, may, by written notice, require the Concessionaire to suspend forthwith for such period as considered necessary, the whole or any part of the procurement of the New Assets or Construction Works, if in its reasonable opinion the same is being carried on in a manner that is not in conformity with the Construction Requirements.

v. The Project Facilities shall be deemed to be complete and ready only when the Provisional Completion Certificate or the Completion Certificate is issued for the complete Project Facilities, by the Construction Supervisor and Independent Engineer in accordance with the provisions hereof. For avoidance of doubt, it is clarified that Provisional Completion Certificate or Completion Certificate would be issued separately by the Construction Supervisor and Independent Engineer. However, the COD shall take place only on the date when Provisional Completion Certificate or Completion Certificate have been issued by both Construction Supervisor and Independent Engineer.

Provided if COD is delayed beyond 90 (ninety) days of the Scheduled Project Completion Date, ULB shall be entitled to terminate this Agreement and to appropriate the Performance Security.

6.7. Operation and Maintenance

The Concessionaire shall undertake the Project in accordance with the O&M Requirements, O&M Plan and O&M Manual.

(a) The Concessionaire shall undertake the Operation and Maintenance (O&M) of the Project by itself. However, the Concessionaire may sub-contract part of the O&M activities to a Contractor possessing requisite technical, financial and managerial expertise/ capability; but in either case, the Concessionaire shall remain solely responsible to meet the O&M Requirements.

(b) The Concessionaire shall, during the Operations Period:

(i) well organized and designate and appoint suitable officers/ representatives as it may deem appropriate to supervise the Project, to deal with the Independent Engineer/ ULB and to be responsible for all necessary exchange of information required pursuant to this Agreement;

(ii) conduct all Tests to ascertain compliance with the Development Plan and the O&M Requirements.

(c) The Concessionaire shall during the Operations Period in accordance with the O&M Requirements:

(i) undertake door to door collection of MSW from Persons generating such waste in the Concession Area;
(ii) collect MSW from Persons generating such waste within the Concession Area
(iii) segregation and secondary collection of MSW
(iv) transfer, transport and deliver the MSW collected at the MSW Processing Site.
(v) process the MSW brought to the MSW Processing Site and dump the Landfill Waste at the Landfill Facility

(d) The Concessionaire shall during the Operations Period, collect User Charges, on behalf of the ULB as determined by ULB from time to time.

(i) maintain and update the existing customer database of households available with ULB;
(ii) issue bills in accordance with the notification issued by the ULB;
(iii) collect the User Charges and deposit the same in the Escrow Account specified by ULB on a daily basis. All the cheque/ demand drafts collected shall be in favour of the Escrow Account.
(iv) make a list of Persons, who have not paid the User Charges and submit the same to the ULB for necessary action atleast on a monthly basis.
(v) Prepare and maintain appropriate record of User Charges collected, deposited, unpaid and submit the same to ULB in the manner and the periodicity laid down by the ULB from time to time

ULB at its sole discretion may decide to give incentive to the Concessionaire based on the experience for improving the collection efficiency of the User Charges on mutually agreed terms.

6.8. **Escrow Account**

The Concessionaire shall maintain an escrow account with a bank of repute as acceptable to ULB (**"Escrow Account"**), during the subsistence of this Agreement and enter into an agreement with such bank and ensure that all the monies collected towards the User Charges are deposited into the Escrow Account.

Withdrawals and appropriations by ULB during the Operations Period, at any relevant time, from the Escrow Account shall be towards payment of Tipping Fee.

Provided that ULB shall be at liberty to withdraw any sums outstanding in the Escrow Account after all the aforesaid payments due have been made and adequate reserves for next 1 (one) year of estimated Tipping Fee have been created.

6.9. Repair and Replacement

(a) The Concessionaire shall at its cost, plan for replacement, replenishment and renewal as the case may be of the Project Facilities (including equipment/ vehicles) well ahead of the time when the Project Facilities thereof is reasonably expected to expire its operating life or its impending obsolescence and replace the Project Facilities in accordance with Good Industry Practice so as to ensure that the Project commensurate with the requirements of this Agreement, at all times during the Concession Period.

(b) In case an irreparable damage to a vehicle and/or equipment, due to any reason (including but not limited to Force Majeure), the Concessionaire shall at its cost, within a maximum period of 30 (thirty) days, replace the damaged vehicle and/or equipment.

(c) The Concessionaire shall not remove from the Project Facilities, any equipment, materials, consumable and non-consumable items that are required for the Project, without the prior written consent of ULB.

(d) The Concessionaire shall maintain and complete accurate records of all equipment, materials, consumables and spare parts procured and shall provide copies of such records to ULB upon request.

6.10. Operation And Maintenance Plan and Operation And Maintenance Manual

Prior to making a request for issue of Project Completion Certificate for the Project, the Concessionaire shall, in consultation with ULB/ Independent Engineer, finalise:

(a) an O&M Plan (**"O&M Plan"**) prepared in line with the Scope of Work of the Project, Statutory Requirement, Development Plan and compliance with the requirements of this Agreement.

(b) a manual for the operations, regular and preventive maintenance of the Project Facilities (**"O&M Manual"**) and shall ensure and procure that at all times during the Concession Period, the Project Facilities are operated and maintained in accordance with the provisions hereof.

6.11. **Not Used**

6.12. Vehicle Tracking and Monitoring System

The Concessionaire shall, at its own cost and expense install a Vehicle Tracking and Monitoring System in all the vehicles used by the Concessionaire for collection and transportation of MSW including the vehicles provide by the ULB. The Vehicle Tracking and Monitoring System should be able to provide the real time data related to the time, position and route taken by the vehicles and generate reports in the manner desired by the ULB.

6.13. Indemnification Against Accidents

(a) The Concessionaire shall be solely responsible for and keeps the ULB indemnified against all the claims, damages, expenses, losses or injury to persons or property that may arise during the Concession Period by use of Project Facilities or part thereof including the vehicles/ equipment provide by the ULB.

(b) On the occurrence of an accident which leads or may lead to human loss, the Concessionaire shall within 24 (twenty four) hours of such accident, report in writing to the ULB clearly stating the facts in sufficient details explaining the circumstances of such accident and the subsequent actions taken by the Concessionaire.

(c) In the event, compensation may become payable under any act or by judgment of any court/ competent authority thereof whether such compensation become payable by the Concessionaire or by the ULB, the same shall be borne and paid by the Concessionaire. If Concessionaire fails to pay the requisite compensation, ULB shall have the right to recover the same by encashment of the Performance Security and/ or from the Tipping Fees payable to the Concessionaire.

6.14. Insurance

6.14.1. The Concessionaire shall at its cost and expense, purchase and maintain by due re-instatement or otherwise, during the Concession Period all insurances in respect of the Project Facilities in accordance with the Good Industry Practice and have the same duly certified by the Independent Engineer interalia the following:

(a) Contractor's all risk insurance;
(b) Cash-in-transit and cash-in-safe insurance in respect of the collections towards User Charges;
(c) loss, damage or destruction of the Project Facilities, at replacement value;
(d) comprehensive third party liability insurance including injury or death to personnel of the ULB and others who may enter the Project Facilities;
(e) workmen's compensation insurance;
(f) any other insurance that may be necessary to protect the Concessionaire, its employees, Project Facilities (against loss, damage or destruction at replacement value) including all Force Majeure Events that are insurable and not otherwise covered in items (a) to (d).

The Concessionaire shall effect all such insurances with an insurer and on terms approved by ULB and if required by ULB in its sole discretion, in the joint names of ULB and the Concessionaire.

The Concessionaire shall maintain a register of entry in order of premiums paid towards the insurance and proof of payments made shall be submitted to ULB whenever requested for.

6.14.2. Application of Insurance Proceeds

Unless otherwise provided herein, the proceeds of all insurance policies received shall be promptly applied by the Concessionaire towards repair, renovation, restoration or re-instatement of the Project Facilities or any part thereof which may have been damaged or destroyed.

6.14.3. Un-insurable Risks

If during the Concession Period, any risk which has been previously insured becomes un-insurable due to the fact that the insurers have ceased to insure such a risk and therefore insurance cannot be maintained/re-instated in respect of such risk, the Concessionaire shall not be deemed to be in breach of its obligations regarding insurance under this Agreement.

6.15. Environmental Compliance

The Concessionaire shall, at all times, ensure that all aspects of the Project and the processes employed in the construction, operation and maintenance of the Project Facilities shall conform to the laws pertaining to environment, health and safety aspects including rules such as MSW Rules, policies and guidelines related thereto. The Concessionaire shall obtain and maintain from time to time necessary clearances from all Government Agencies and for this purpose shall carry out, in accordance with Applicable Laws, the necessary environmental impact assessment studies and

implement appropriate environment management plans and submit necessary reports (including the reports to be submitted by ULB) as per Applicable Laws.

6.16. Land Use

The Concessionaire shall ensure optimum utilisation of the Project Site and shall not use the same for any purpose unconnected or which is not incidental to the Project or related activities.

6.17. Weighment of MSW

The Concessionaire shall weigh, in presence of the Independent Engineer and authorized representative of ULB, the incoming MSW collected and transported by it at the entry gate to the MSW Processing Site ("Incoming Waste") and weigh the Landfill Waste prior to disposal of the same in the Landfill Facility in the manner as set out in the O&M Requirements. The record of weighment shall be jointly signed by the Independent Engineer and authorized representative of ULB and Concessionaire. The Concessionaire would keep a record of the same for a period of at least 10 (ten) years.

6.18. Reject Biomedical Waste, Hazardous Waste, Radioactive Waste

In case Biomedical / Hazardous Waste/ radioactive waste is found to be mixed with the MSW, the Concessionaire shall segregate the same and transport it to the location as decided by the ULB for its further disposal by the ULB.

6.19. Processing of MSW

The Concessionaire may adopt such processes and methods as it considers necessary or expedient for Processing of MSW and Landfilling at the Project Facilities, subject to meeting the Construction Requirements and O&M Requirements and Landfill Waste is not more than 20% of Incoming Waste. However, the Concessionaire shall use composting of MSW as one of the main processes.

6.20. Sale/Distribution of Compost and Other Recyclables

The Concessionaire shall be free to sell or dispose of the recyclables, compost or organic manure, RDF, energy (power) and/ or other material recovered after Processing the MSW, at the Project Facilities at such price and to such Persons and using such marketing and selling arrangements and strategies as it may deem appropriate subject to meeting the O&M Requirements.

6.21. Landfilling

The Concessionaire shall carry out Landfilling, including carrying out of relevant Tests, maintenance of records and ensure certification by Independent Engineer, in

accordance with O&M Requirements. The Concessionaire shall weigh the Landfill Waste prior to disposal of the same in the Landfill Facility and it shall not be more than 20% (twenty per cent) of the Incoming Waste.

6.22. Maintenance of Warranties

The Concessionaire shall honour and preserve all product warranties for machinery and equipment (including the warranties provided by respective OEM). Further the Concessionaire shall take the appropriate action for the same.

6.23. Carbon Credits

The Concessionaire shall endeavor to obtain the carbon credits under Clean Development Mechanism (CDM) of the Kyoto Protocol for the Project by adopting the greenhouse gas mitigation measures. The benefits of such carbon credits, if and when available, would be retained by the Concessionaire.

6.24. Shareholding

(a) **Ownership:** The Selected Bidder /Consortium has caused the Concessionaire to be incorporated as a special purpose company with the sole objective of implementing the Project in accordance with this Agreement. The shareholding pattern of Concessionaire/each member of the Consortium in the Concessionaire is as follows:

Name of the shareholder	Number of shares held	Nominal/ face value per share	Percentage in total share capital of the Concessionaire

Equity Lock-In

(b) The Concessionaire shall ensure that the shareholding in it's issued and paid up equity share capital shall be as per the following:

(i) Where the Selected Bidder is a sole bidder, it shall hold at least 51% of the issued and paid up equity share capital of the Concessionaire throughout the entire Concession Period;

(ii) Where the Selected Bidder is a bidding Consortium, the Lead Member shall hold at least 51% of the issued and paid up equity share capital of the Concessionaire throughout the entire Concession Period. The other Members whose Eligible Experience Criteria and/or Technical Capability and/or Financial Capability have been considered for the purpose of qualification as per the RFP shall hold at least 10% of the issued and paid up equity share capital of the Concessionaire throughout the entire Concession Period.

(c) If the Selected Bidder, Lead Member or Member, as the case may be, invests through any Associate, the Concessionaire shall ensure that:

(i) such Associate shall be subject to the above equity lock-in as applicable to the Successful Bidder, Lead Member and/or Member, as the case may be.

(ii) the Selected Bidder, Lead Member or other Members shall be liable to ensure that the entity that it is relying upon as an Associate to discharge the above equity lock-in requirement continues to be its Associate during the above equity lock-in period as applicable.

6.25. Awareness Campaign

The Concessionaire shall assist the ULB in organizing and conducting the public awareness programs.

6.26. Post Closure Operations of the Landfill Facility

(a) At least 3 (three) months before the expected expiry of the Landfill Life, the Parties jointly with the Independent Engineer shall, in accordance with Schedule G, discuss and jointly prepare the Post Closure Operating Plan for maintenance of the Landfill Facility, under the provisions of the applicable statutory regulations ("Post Closure Maintenance Plan").

(b) The Concessionaire shall after expiry of the Landfill Life maintain the Landfill Facility in accordance with the Post Closure Maintenance Plan for Post Closure Period.

6.27. Not Used

6.28. Not Used

6.29. Books of Account

6.29.1. The Concessionaire shall maintain books of accounts recording all its receipts (including Tipping Fee and other revenues derived/ collected by it from or on account of the Project and/or its use), collection of User Charges on behalf of ULB, income, expenditure, assets and liabilities, in accordance with this Agreement, Good Industry Practice, Applicable Laws and Applicable Permits. The Concessionaire shall provide 2 (two) copies of its Balance Sheet, Cash Flow Statement and Profit and Loss Account along with a report thereon by its Statutory Auditors, within 6 (six) months of the close of the Accounting Year to which they pertain. In addition the Concessionaire shall also submit a statement of fixed assets forming part of the Project Facility, as on the end of the Accounting Year, duly certified by the Statutory Auditor. The statement of fixed assets shall provide the inventory of fixed assets as

on the end of Accounting Year along with a list of additions and deletions during the period.

6.29.2. The ULB or its authorised representatives shall have the right to inspect the records of the Concessionaire during office hours and require copies of relevant extracts of books of accounts to be provided to the ULB and in the event of any discrepancy or error being found, the same shall be rectified by the Concessionaire in its books of account.

6.30. General Obligations

6.30.1. Subject to and in accordance with the terms and conditions of this Agreement, the Concessionaire shall to the satisfaction of the ULB, with due care and diligence, design and execute the Construction Works as is required under the Construction Requirements and carry out its other obligations under and/or in relation to or reasonably to be inferred from the Agreement and provide all personnel and labour, including the supervision thereof, materials, offices, workshops, tools, machinery, equipment and all other resources and things, whether of a temporary or permanent nature, required in or for such design and execution and for carrying out such obligations.

The personnel and labour used by the Concessionaire for the Project shall be responsibility of the Concessionaire and ULB shall in no case be responsible, in any manner to such personnel and labour.

6.30.2. The Concessionaire shall assume full responsibility for the proper and timely design and execution of the Construction Works in accordance with this Agreement.

6.30.3. The Concessionaire shall be fully responsible for the acts or omissions of all its employees, agents, workmen, suppliers, consultants, Contractors and any other persons for whom it is contractually responsible for, as if such acts of omissions were its own.

6.30.4. The Concessionaire shall be responsible for maintaining the Project Facilities so as to keep it in good operable conditions which shall include but is not limited to all day-to-day maintenance and repairs of the Project Facility and replacement of equipments / consumables (irrespective of actual usage and loading levels and irrespective of whether the maintenance, repair or replacement work is required because of any defect in the Project Facility (latent or otherwise) or due to faulty workmanship or defective design or construction or any other reason whatsoever and whether or not it is known to the ULB);

6.30.5. The Concessionaire shall at its own cost and expense:

a. design, engineer, procure, finance, modify, construct, operate, maintain and transfer the Project Facilities in accordance with the provisions hereof;

b. comply with Applicable Laws at all times during the Concession Period;

c. endeavor to improve the ancillary conditions and infrastructure related to the Project, including assistance to informal recycling workers;

d. endeavour to sell or otherwise dispose of all recyclables in a manner which is not detrimental to the environment;

e. assist in carrying out Awareness Campaign in accordance with the provisions of Schedule N;

f. provide uniforms for all its employees/ Contractor's personnel which shall be worn by such employees/personnel while on duty;

g. be responsible for transportation of Landfill Waste from MSW Processing Facility to the Landfill Facility;

h. register vehicles used for transportation of segregated MSW with the concerned Government Agencies and ensure that all taxes are paid up-to-date on such vehicles;

i. procure and maintain in full force and effect, as necessary, appropriate proprietary rights, licenses, agreements and permissions for materials, methods, processes and systems used in or incorporated into the Project;

j. make efforts to maintain harmony and good industrial relations among the personnel employed in connection with the performance of its obligations under this Agreement and shall be solely responsible for compliance with all labour laws and solely liable for all possible claims from any third party and employment related liabilities of its staff employed in relation with the Project and hereby indemnifies ULB against any claims, damages, expenses or losses in this regard and that in no case and shall for no purpose shall ULB be treated as employer in this regard;

k. make its own arrangements for construction materials and observe and fulfill the environmental and other requirements under the Applicable Laws and Applicable Permits;

l. be responsible for quality, soundness, durability, safety and the overall Construction Requirements and O&M Requirements;

m. be responsible for all the security, environment and safety aspects of the Project at all times during the Concession Period.

n. ensure that the Project Facilities remain free from all encroachments and take all steps necessary to remove encroachments, if any;

o. upon receipt of a request thereof, afford access to the MSW Processing Site/ Project Facilities to the authorised representatives of ULB for the purpose of ascertaining compliance with the terms, covenants and conditions of this Agreement;

p. pay all taxes, duties and outgoings, including utility charges relating to the Project Facilities.

q. establish a standard protocol for addressing complaints from Persons in the Concession Area to the satisfaction of the Independent Engineer in accordance with the O&M Requirements.

r. submit reports regarding matters specified in Schedule F and G.

6.31. Damages for shortfall/non-compliance in Operations & Maintenance Performance

6.31.1. In the event the ULB, whether from the review of reports submitted by the Concessionaire/ Independent Engineer in accordance with the provisions of this Agreement or otherwise, observes that the Project/Project Facilities do not comply or fall short of performance as per the provisions of this Agreement, the ULB may levy the amount of Damages payable by the Concessionaire in accordance with Schedule O of this Agreement and demand the Concessionaire by a notice in writing to pay the same within 30 (thirty) days and on failure of the Concessionaire to pay the same, the ULB shall recover the amount from the Concessionaire from the monthly Tipping Fee invoice and/ or by encashment of the Performance Security. Provided that upon receipt of the demand the Concessionaire may make a written representation to the ULB which shall be considered by the ULB on merits and the ULB may waive the payment of Damages in part or full, if it is satisfied that the Concessionaire has been carrying out its obligations diligently and efficiently and the shortfall to be waived was on account of reasons beyond the control of the Concessionaire. The Concessionaire shall pay such Damages forthwith and in the event that it contests such Damages, the Dispute Resolution procedure shall apply.

6.31.2. The ULB shall review the above performance of the Concessionaire and may levy Damages on monthly basis in accordance with Schedule O.

6.31.3. The Damages set forth in Article 6.31.1 may be assessed and specified forthwith by the Independent Engineer; provided that the ULB may, in its discretion, demand a smaller sum as Damages, if in its opinion, the breach has been cured promptly and the Concessionaire is otherwise in compliance with its obligations under this Agreement.

6.31.4. It is clarified that this provision does not prejudice the rights of the ULB upon a Concessionaire Event of Default as set out in Article 12.1 including the ULB's right to terminate this Agreement which shall remain unaffected.

6.32. Breach of O&M Obligations

6.32.1. The Concessionaire shall be deemed to be in Material Breach of O&M Requirements, if the Independent Engineer acting reasonably and in accordance with the provisions of this Agreement, has determined that due to breach of its obligations by the Concessionaire:

(i) there has been failure/ undue delay in carrying out scheduled/ planned maintenance or the scheduled/ planned maintenance has not been carried out in accordance with the O&M Requirements;

(ii) The maintenance of the Project Facilities or any part thereof has deteriorated to a level which is below the acceptance level prescribed by the O&M Requirements;

(iii) There has been a serious or persistent let up in adhering to the O&M Requirements and thereby the Project Facilities or any part thereof is not safe for operations;

(iv) There has been persistent breach of O&M Requirements.

For avoidance of doubt, persistent breach shall mean:

(i) any breach of O&M Requirements by the Concessionaire which has not been remedied by the Concessionaire despite a notice to remedy in respect thereof issued by the Independent Engineer/ ULB;

(ii) recurrence of a breach by the Concessionaire, during the pendency of notice to remedy by the Independent Engineer/ ULB, requiring the Concessionaire to remedy a breach, and

(iii) repeated occurrence of a breach notwithstanding that earlier breaches have been remedied pursuant to notice to remedy or otherwise.

Upon occurrence of a material breach of O&M Requirements, ULB shall, without prejudice to and notwithstanding any other consequences provided therefor under this Agreement, depending upon the nature of the obligation in respect of which a Material Breach has occurred, be entitled to either levy Damages and thereafter terminate this Agreement, if such breach takes place for 4 consecutive weeks or in respect of breach of obligations by the Concessionaire which are of a serious nature, immediately terminate this Agreement.

6.33. No Breach of Obligations

The Concessionaire shall not be considered to be in breach of its obligations under this Agreement nor shall it incur or suffer any liability if and to the extent performance of any of its obligations under this Agreement is affected by or on account of any of the following:

(a) Force Majeure Event, subject to Article 11.3;

(b) ULB Event of Default;

(c) Compliance with the instructions of the Construction Supervisor / Independent Engineer /ULB or the directions of any Government Agency.
Provided that the instructions should not have been issued as a consequence of a breach by the Concessionaire of any of its obligations under this Agreement; or

(d) Closure of the Project Facilities or part thereof with the approval of the ULB.

ARTICLE 7

ULB's OBLIGATIONS

In addition to and not in derogation or substitution of any of its other obligations under this Agreement, ULB shall have the following obligations:

7.1 Specific obligations

The ULB shall:

a. declare and maintain, or cause to declare and maintain, a no-development zone around the MSW Processing Site in accordance with Applicable Laws.

b. notify the User Charges, if any to be collected along with the mechanism for collection, recovery from defaulters, etc.

c. facilitate the Concessionaire in collection of User Charges in case of non-payment of User Charges by any person as per the procedure laid down by the ULB from time to time.

d. grant in a timely manner all such approvals, permissions and authorizations which the Concessionaire may require or is obliged to seek from ULB under this Agreement, in connection with implementation of the Project and the performance of its obligations. Provided that where authorizations for availing of utilities such as power, water, sewerage, telecommunications or

any other incidental services/utilities is required, the same shall be provided by ULB in the form as set out in Schedule M within 15 (fifteen) days from receipt of request from the Concessionaire to make available such authorization.

7.2 General obligations

The ULB shall:

(i) upon written request from the Concessionaire and subject to the Concessionaire complying with Applicable Laws, provide reasonable support and assistance to the Concessionaire in procuring Applicable Permits required from any Government Agency for implementation of the Project. It is clarified that, the Concessionaire shall be solely responsible for obtaining all Applicable Permits;

(ii) observe and comply with all its obligations set forth in this Agreement.

7.3 Change in location of Landfill Facility

ULB may upon expiry of active Landfill Life, be entitled to change the location of the Landfill Facility to a new location. In such a case, both the Parties shall hold discussions in good faith and may conduct necessary surveys/ studies, to revise the Tipping Fees on mutually agreed terms to account for the differential distance to be travelled by the vehicles for dumping of Landfill Waste.

7.4 Procurement and Transfer of Equipments/ Vehicles

The ULB shall, within 90 days of the Appointed Date, procure, in consultation with the Concessionaire, Independent Engineer and in accordance with the Development Plan, the equipments/ vehicles for value aggregating for an amount upto Rs. _____ through an open transparent competitive bidding process.

These equipments shall be handed over to the Concessionaire by the ULB within 10 days of delivery to ULB and thereafter considered as part of the Existing Assets.

ARTICLE 8

Not Used

ARTICLE 9

Capital Grant

9.1 Capital Grant for the Project

Subject to the provisions of this Agreement and in consideration of the Concessionaire accepting the Concession and undertaking to perform and discharge its obligations in accordance with the terms, conditions and covenants set forth in this Agreement, ULB agrees to provide the one time capital grant for construction of compost processing plant and Sanitary Landfill (the "**Capital Grant**") to the Concessionaire of Rs. _____ lakhs.

Sr. No	Milestone	Prerequisite for Release of payment	% of Contract Price to be Released
1)	On signing of the Agreement	Submission of equivalent Bank Guarantee	15% of Capital Grant
2)	Expenditure on capital work in progress (incurred and paid on compost plant and landfill facility)	Monthly Claim for Capital Grant supported by: (i) A Chartered Accountant certificate certifying the capital expenditure incurred and paid as per the books of account, showing • Total capital expenditure till date • Breakup of the above into compost plant, landfill and other processing facility ii) A statement of work done showing BOQ of the works done and measured quantities by Construction supervisor and % of completion of works duly certified by Construction Supervisor and recommending payment of Capital Grant	75% of the proportionate total capital expenditure incurred and paid vis-à-vis the total estimated project cost as per the Development Plan. Provided the said payment should not be more than the expenditure incurred and paid by the Concessionaire on the compost plant and Landfill Facility

3)	COD	Final Claim for Capital Grant supported by: (i) A Chartered Accountant certificate certifying the capital expenditure incurred and paid as per the books of account, showing • Total capital expenditure till date • Breakup of the above into compost plant, landfill and other processing facility (ii) Issue of Completion Certificate by Construction Supervisor	Balance (10%) amount of the Capital Grant*

Note *: Capital Grant would be paid, subject to the following:

(i) minimum capital expenditure to be incurred on MSW Processing Facility and Landfill Facility shall be Rs. …….. . In case the actual expenditure incurred is less than Rs _____, then the Capital Grant would be reduced proportionately.

(ii) In case the capital expenditure incurred on compost plant and Landfill Facility is more than the Capital Grant, than Capital Grant, would be Rs. ……...

9.2 Mechanism of Payment

(a) ULB shall, within 30 (thirty) days from the date of receipt of the claim for Capital Grant would release the payment to the Concessionaire subject to the fulfillment of the conditions as detailed above.

ARTICLE 10

TIPPING FEE

10.1 Payment of Tipping Fee

Subject to the provisions of this Agreement and in consideration of the Concessionaire accepting the Concession and undertaking to perform and discharge its obligations in accordance with the terms, conditions and covenants set forth in this Agreement, ULB agrees and undertakes to pay Tipping Fee to the Concessionaire as per this Article.

10.2 Tipping Fee

(a) The Tipping Fee for the first year of the operation commencing from the COD shall be payable as per the Tipping Fee rate per MT quoted by the Selected Bidder in its Financial Proposal shall be for the first year of the operations and maintenance year. The Tipping Fee for the subsequent operating years shall be payable as per the Tipping Fee rate per MT quoted for the respective subsequent operations and maintenance year in the Financial Proposal. The Tipping Fee per MT quoted by the Selected Bidder for the first year and the subsequent years are reproduced in Schedule H.

(b) The Concessionaire shall weigh the daily Incoming Waste and Landfill Waste as per Article 6.17.

(c) The Concessionaire shall prepare a monthly invoice duly certified by the authorized representative of ULB responsible for verifying the weighment of MSW and Independent Engineer and submit the monthly invoice by the 7th day of next month. The monthly invoice shall be supported by the original copy of the daily weighment statement duly signed by the authorized representative of ULB responsible for verifying the weighment of Incoming Waste and Independent Engineer alongwith the monthly summary statement giving the following:

(i) Date wise quantity of Incoming Waste and Landfill Waste for the month
(ii) Total quantity of Incoming Waste and Landfill Waste for the month;
(iii) Amount of total Tipping Fee for the month calculated at the applicable quoted Tipping Fee rate set out in Schedule H multiplied with Incoming Waste.

10.3 Mechanism of Payment

(a) ULB shall make the payment, within 30 days from the date of receipt of the Tipping Fee invoice. ULB would retain 2.5% of the Tipping Fee invoice amount towards Post Closure Performance. Further, ULB shall be entitled to make deduction if any,

required in respect of the amount payable by the Concessionaire as per the terms of this Agreement.

(b) ULB shall issue instructions to the Escrow Bank for release of payment from the Escrow Account. In case, Escrow Account has funds less than the amount payable to Concessionaire, ULB shall make the balance payments.

10.4 Post Closure Performance Account

(a) Within 15 (fifteen) days from the COD, ULB shall open a special account designated as Post Closure Performance Account for making the payments in the succeeding Sub-article.

(b) ULB shall deposit the amount retained towards Post Closure Performance into a special account designated as "Post Closure Performance Account".

(c) Subject to the Concessionaire meeting his obligations in respect to the Post Closure Period in accordance with the O&M Requirements, payments from the Post Closure Performance Account shall be made to the Concessionaire in equal quarterly installments of $1/60^{th}$ of the amount balance on the commencement of the Post Closure Period for the respective cell of the Landfill Facility.

10.5 Penalty on over Disposal of Landfill Waste

(a) The Landfill Waste shall be maximum 20% (twenty per cent) of the Incoming Waste.

(b) A penalty of 2% of the amount payable to Concessionaire in the Tipping Fee invoice shall be imposed for every 1% increase in the Landfill Waste (of the Incoming Waste).

(c) The penalty shall be computed taking average performance of the Concessionaire for the Landfill Facility operations for the respective calendar month.

(d) In case, Landfill Waste is more than 25% (twenty five per cent) of Incoming Waste regularly for a period of [one month], it shall be treated as Concessionaire Event of Default under this Agreement.

ARTICLE 11

FORCE MAJEURE

11.1 Force Majeure Event

Any of the following events which is beyond the control of the Party claiming to be affected thereby ("**Affected Party**"), and which the Affected Party has been unable to

overcome or prevent despite exercise of due care and diligence, and results in Material Adverse Effect shall constitute Force Majeure Event:

(a) earthquake, flood, inundation, landslide, fire, ionising radiation, contamination by radioactivity from nuclear fuel, any nuclear waste, radioactive toxic explosion, volcanic eruptions caused by reasons not attributable to the Concessionaire or any of the employees, contractors or agents of the Concessionaire

(b) storm, tempest, hurricane, cyclone, lightning, thunder or other extreme atmospheric disturbances;

(c) any judgment or order of a court of competent jurisdiction or statutory authority in India made against the Concessionaire or the Contractor in any proceedings which is non-collusive and duly prosecuted by the Concessionaire, and

(d) acts of terrorism, war, hostilities (whether declared or not), invasion, act of foreign enemy, rebellion, riots, weapon conflict or military actions, civil war;

(e) strikes, labour disruptions, any other industrial disturbances or public unrest not arising on account of the acts or omissions of the Concessionaire or the Contractor;

(f) action of a Government Agency having Material Adverse Effect, including but not limited to:

  (i) acts of expropriation, compulsory acquisition or takeover by any Government Agency of the Project/Project Facilities or any part thereof or of the Concessionaire's or the Contractor's rights in relation to the Project,
  (ii) any unlawful, unauthorised or without jurisdiction refusal to issue or to renew or the revocation of any Applicable Permits, in each case, for reasons other than Concessionaire's or the Contractor's breach or failure in complying with the Construction Requirements, O&M Requirements, Applicable Laws, Applicable Permits, any judgment or order of a Governmental Agency or of any contract by which the Concessionaire or the Contractor as the case may be is bound.

(g) early termination of this Agreement by ULB for reasons of national emergency or national security.

11.2 Notice of Force Majeure Event

(a) As soon as practicable and in any case within 7 (seven) days of the date of occurrence of a Force Majeure Event or the date of knowledge thereof, the

Affected Party shall notify Independent Engineer and the other Party of the same setting out, inter alia, the following in reasonable detail:

(i) the nature and extent of the Force Majeure Event;

(ii) the estimated Force Majeure period;

(iii) the nature of and the extent to which, performance of any of its obligations under this Agreement is affected by the Force Majeure Event;

(iv) the measures which the Affected Party has taken or proposes to take to alleviate/mitigate the impact of the Force Majeure Event and to resume performance of such of its obligations affected thereby; and

(v) Any other relevant information concerning the Force Majeure Event, and /or the rights and obligations of the Parties under this Agreement.

(b) As soon as practicable and in any case within 5 days of notification by the Affected Party in accordance with the preceding Sub-article(a), the Parties shall along with the Independent Engineer, meet, hold discussions in good faith and where necessary conduct physical inspection/survey of the Project Facilities in order to:

(i) assess the impact of the underlying Force Majeure Event,

(ii) to determine the likely duration of Force Majeure period and,

(iii) to formulate damage mitigation measures and steps to be undertaken by the Parties for resumption of obligations, the performance of which shall have been affected by the underlying Force Majeure Event.

(c) The Affected Party shall during the Force Majeure period provide to the other Party and the Independent Engineer regular (not less than weekly) reports concerning the matters set out in the preceding Sub-article (b) as also any information, details or document, which the other Party may reasonably require.

11.3 Performance of Obligations

If the Affected Party is rendered wholly or partially unable to perform any of its obligations under this Agreement because of a Force Majeure Event, it shall be excused from performance of such obligations to the extent it is unable to perform the same on account of such Force Majeure Event provided that:

(a) due notice of the Force Majeure Event has been given as required by the preceding Article 11.2 (a);

(b) the excuse from performance shall be of no greater scope and of no longer duration than is necessitated by the Force Majeure Event;

(c) the Affected Party has taken all reasonable efforts to avoid, prevent, mitigate and limit damage, if any, caused or is likely to be caused to the Project Facilities as a result of the Force Majeure Event and to restore the Project Facilities, in accordance with the Good Industry Practice and its relative obligations under this Agreement;

(d) when the Affected Party is able to resume performance of its obligations under this Agreement, it shall give to the other Party and the Independent Engineer written notice to that effect and shall promptly resume performance of its obligations hereunder, the non issue of such notice being no excuse for any delay for resuming such performance;

(e) the Affected Party shall continue to perform such of its obligations which are not affected by the Force Majeure Event and which are capable of being performed in accordance with this Agreement;

(f) any insurance proceeds received shall be entirely applied to repair, replace or restore the assets damaged on account of the Force Majeure Event, or in accordance with Good Industry Practice.

11.4 Termination due to Force Majeure Event

(a) **Termination**

(i) If a Force Majeure Event, excluding events described under Articles 11.1(f), and 11.1 (g), continues or is in the reasonable judgment of the Parties likely to continue beyond a period of 60 (sixty) days, the Parties may mutually decide to terminate this Agreement or continue this Agreement on mutually agreed revised terms. If the Parties are unable to reach an agreement in this regard, the Affected Party shall after the expiry of the said period of 60 (sixty) days, be entitled to terminate this Agreement.

Notwithstanding anything inconsistent contained in this Agreement, if a Force Majeure Event is an event described under Articles 11.1(f) and the same subsists for a period exceeding 180 (one hundred and eighty) days, then either Party shall be entitled to terminate this Agreement.

Provided that ULB may at its sole discretion have the option to terminate this Agreement any time after the occurrence of any event described under Articles 11.1(f).

(b) **Termination Notice**

If either Party, having become entitled to do so, decides to terminate this Agreement pursuant to the preceding sub-article (a), it shall issue Termination Notice setting out:

(i) in sufficient detail the underlying Force Majeure Event;

(ii) the Termination Date which shall be a date occurring not earlier than 30 days from the date of Termination Notice;

(iii) the estimated Termination Payment including the details of computation thereof; and

(iv) any other relevant information.

(c) **Obligation of Parties**

Following issue of Termination Notice by either Party, the Parties shall promptly take all such steps as may be necessary or required to ensure that:

(i) the Termination Payment, if any, payable by ULB in accordance with the following sub-article (d) is paid to the Concessionaire on the Termination Date; and

(ii) the Project Facilities is handed over to ULB by the Concessionaire on the Termination Date free from any Encumbrance.

(d) **Termination Payment**

Upon Termination of this Agreement due to a Force Majeure Event, Termination Payment shall be made to the Concessionaire by ULB in accordance with the following:

(i) If Termination is due to a Force Majeure Event, described under Articles 11.1 (a) to (c), Termination Payment payable to the Concessionaire shall be equal to 70% of the Book Value less Insurance Cover.

(ii) If Termination is due to the occurrence of any event described under Articles 11.1(d), or 11.1(e), ULB shall make a Termination Payment to

the Concessionaire of an amount equal to 100% of the Book Value less Insurance Cover.

(iii) If Termination is due to the occurrence of the event described under Article 11.1 (f) or 11.1 (g), ULB shall make a Termination Payment to the Concessionaire of an amount that would be payable under Article 12.2(f) as if it were ULB Event of Default.

Provided ULB shall be entitled to deduct from the Termination Payment any amount due and recoverable by ULB from the Concessionaire as on the Termination Date.

Provided, no Termination Payment shall be payable to the Concessionaire if the Concessionaire fails to maintain Insurance Cover in accordance with Article 6.14 of this Agreement.

11.5 Liability for other losses, damages etc.

Save and except as expressly provided in this Article, neither Party hereto shall be liable in any manner whatsoever to the other Party in respect of any loss, damage, cost, expense, claims, demands and proceedings relating to or arising out of occurrence or existence of any Force Majeure Event.

ARTICLE 12

EVENTS OF DEFAULT AND TERMINATION

12.1 Events of Default

Event of Default means either Concessionaire Event of Default or ULB Event of Default or both as the context may admit or require.

(a) Concessionaire Event of Default

Any of the following events shall constitute an event of default by the Concessionaire ("**Concessionaire Event of Default**") unless such event has occurred as a result of one or more reasons set out in Article 6.33:

(i) The Concessionaire fails to submit the Development Plan/ Drawings beyond 45 (forty five) days of the specified time;

(ii) The Concessionaire fails to comply with the Development Plan/ Drawings having a Material Adverse Effect on the Project;

(iii) The Concessionaire has failed to adhere to the Construction Requirements and such failure, in the reasonable estimation of the

Independent Engineer, is likely to delay achievement of COD beyond 90 days of the Scheduled Project Completion Date or has actually resulted in the Concessionaire not achieving COD within 90 (ninety) days of the Scheduled Project Completion Date;

(iv) At any time during the Operations Period, the Concessionaire fails to adhere to the Construction Requirements or O&M Requirements and has failed to remedy the same or has failed to take any effective steps to remedy the same within 45 (forty five) days of receipt of notice from ULB;

(v) The Concessionaire has failed to make payment of any sum that has become due and payable to ULB under provisions of this Agreement and such amount remains unpaid for a period beyond 45 days;

(vi) The Concessionaire has failed to prepare and submit reports referred to in Schedule F and G in accordance with this Agreement and such failure continues for a period of more than 60 (sixty) days after intimation by ULB;

(vii) The Concessionaire has failed to ensure minimum shareholding requirements specified in Article 6.24.

(viii) The Concessionaire is in Material Breach of any of its obligations under this Agreement and the same has not been remedied for more than 30 (thirty) days;

(ix) Any representation made or warranty given by the Concessionaire under this Agreement is found to be false or misleading;

(x) A resolution for voluntary winding up has been passed by the shareholders of the Concessionaire;

(xi) Any petition for winding up of the Concessionaire has been admitted and liquidator or provisional liquidator has been appointed or the Concessionaire has been ordered to be wound up by Court of competent jurisdiction, except for the purpose of amalgamation or reconstruction with the prior consent of ULB, provided that, as part of such amalgamation or reconstruction and the amalgamated or reconstructed entity has unconditionally assumed all surviving obligations of the Concessionaire under this Agreements

(xii) The Concessionaire has abandoned the Project or the Project Facilities;

(xiii) The Concessionaire has unlawfully repudiated this Agreement or has otherwise expressed an intention not to be bound by this Agreement;

(xiv) The Concessionaire has suffered an attachment levied on any of its assets which has caused or is likely to cause a Material Adverse Affect on the Project and such attachment has continued for a period exceeding 45 (forty five) days;

b) ULB Event of Default

Any of the following events shall constitute an event of default by ULB ("**ULB Event of Default**"), unless caused by a Concessionaire Event of Default or a Force Majeure Event:

(i) ULB has failed to make any payments due to the Concessionaire and more than 180 (one hundred and eighty) days have elapsed since such default;

(ii) ULB has failed to deliver possession of any of the Existing Assets to the Concessionaire or failed to provide adequate access to or Project Site within 45 (forty five) days from the date of receipt of notice from the Concessionaire in that regard;

(iii) ULB is in Material Breach of any of its obligations under this Agreement and has failed to cure such breach within 30 (thirty) days of receipt of notice thereof issued by the Concessionaire;

(iv) Upon expiry of life of the Landfill Site, ULB fails to provide land for the new landfill site within the mutually agreed time period;

(v) ULB has unlawfully repudiated this Agreement or otherwise expressed its intention not to be bound by this Agreement;

(vi) ULB has unreasonably withheld or delayed grant of any approval or permission which the Concessionaire is obliged to seek under this Agreement, and thereby caused or likely to cause Material Adverse Effect; and

(vii) Any representation made or warranties given by the ULB under this Agreement has been found to be false or misleading.

12.2 Termination due to Event of Default

(a) Termination for Concessionaire Event of Default

(i) Without prejudice to any other right or remedy which ULB may have in respect thereof under this Agreement, upon the occurrence of a Concessionaire Event of Default, ULB may terminate this Agreement

in the manner as set out under Article 12.2(a)(ii) and Article 12.2(a)(iii).

(ii) If ULB decides to terminate this Agreement pursuant to preceding Sub-article (i), it shall in the first instance issue Preliminary Notice to the Concessionaire. Within 30 (thirty) days of receipt of the Preliminary Notice, the Concessionaire shall submit to ULB in sufficient detail, the manner in which it proposes to cure the underlying Event of Default (the "Concessionaire's Proposal to Rectify"). In case of non-submission of the Concessionaire's Proposal to Rectify within the said period of 30 (thirty) days, ULB shall be entitled to terminate this Agreement by issuing Termination Notice, and to appropriate the Performance Security, if subsisting and upon certification by the Independent Engineer to the bank where the Post Closure Performance Account is held amounts in the said account.

(iii) If the Concessionaire's Proposal to Rectify is submitted within the period stipulated therefor, the Concessionaire shall have further period of 30 (thirty) days to remedy/ cure the underlying Event of Default. If, however the Concessionaire fails to remedy/cure the underlying Event of Default within such further period allowed, ULB shall be entitled to terminate this Agreement, by issue of Termination Notice and to appropriate the Performance Security, if subsisting and upon certification by the Independent Engineer to the bank where the Post Closure Performance Account is held, amounts in the said account.

(b) Termination for ULB Event of Default

(i) Without prejudice to any other right or remedy which the Concessionaire may have in respect thereof under this Agreement, upon the occurrence of ULB Event of Default, the Concessionaire shall be entitled to terminate this Agreement by issuing Termination Notice.

(ii) If the Concessionaire decides to terminate this Agreement pursuant to preceding Sub-article (i) it shall in the first instance issue Preliminary Notice to ULB. Within 30 days of receipt of Preliminary Notice, ULB shall forward to the Concessionaire its proposal to remedy/ cure the underlying Event of Default (the "ULB Proposal to Rectify"). In case of non submission of ULB Proposal to Rectify within the period stipulated therefor, Concessionaire shall be entitled to terminate this Agreement by issuing Termination Notice.

(iii) If ULB Proposal to Rectify is forwarded to the Concessionaire within the period stipulated therefor, ULB shall have further period of 30 days to remedy/ cure the underlying Event of Default. If, however ULB fails to remedy/ cure the underlying Event of Default within such further period

allowed, the Concessionaire shall be entitled to terminate this Agreement by issuing Termination Notice.

(c) Termination Notice

If a Party having become entitled to do so decides to terminate this Agreement pursuant to the preceding sub-article (a) or (b), it shall issue Termination Notice setting out:

(i) in sufficient detail the underlying Event of Default;

(ii) the Termination Date which shall be a date occurring not earlier than 60 days from the date of Termination Notice;

(iii) the estimated termination payment including the details of computation thereof; and,

(iv) any other relevant information.

(d) Obligation of Parties

Following issue of Termination Notice by either Party, the Parties shall promptly take all such steps as may be necessary or required to ensure that:

i until Termination the Parties shall, to the fullest extent possible, discharge their respective obligations so as to maintain the continued operation of the Project Facilities,

ii the termination payment, if any, payable by ULB in accordance with the following Sub-article (f) is paid to the Concessionaire on the Termination Date and

iii the Project Facilities are handed over to ULB by the Concessionaire on the Termination Date free from any Encumbrance along with any payment that may be due by the Concessionaire to ULB.

(e) Withdrawal of Termination Notice

Notwithstanding anything inconsistent contained in this Agreement, if the Party who has been served with the Termination Notice cures the underlying Event of Default to the satisfaction of the other Party at any time before the Termination occurs, the Termination Notice shall be withdrawn by the Party which had issued the same.

Provided that the Party in breach shall compensate the other Party for any direct costs/consequences occasioned by the Event of Default which caused the issue of Termination Notice.

(f) Termination Payments

(i) Upon Termination of this Agreement on account of ULB Event of Default, ULB shall release the Performance Security, if subsisting, and ULB shall pay to the Concessionaire, by way of Termination Payment, an amount equal to 120% of Book Value.

Provided that no Termination Payment shall be due or payable to the Concessionaire on account of a ULB Event of Default relating to non-achievement of Appointed Date.

(ii) Upon Termination of this Agreement on account of Concessionaire Event of Default, ULB shall pay to the Concessionaire, by way of Termination Payment, an amount equal to 70% of the Book Value .

For the avoidance of doubt, the Concessionaire hereby acknowledges that no Termination Payment shall be due or payable on account of a Concessionaire Event of Default occurring up to 1 year from the COD. Further, the ULB shall forfeit Performance Security and would not release any further Capital Grant.

12.3 Rights of ULB on Termination

(a) Upon Termination of this Agreement for any reason whatsoever, ULB shall upon making the Termination Payment, if any, to the Concessionaire have the power and authority to:

(i) enter upon and take possession and control of the Project Facilities forthwith;

(ii) prohibit the Concessionaire and any Person claiming through or under the Concessionaire from entering upon/ dealing with the Project Facilities;

(b) Notwithstanding anything contained in this Agreement, ULB shall not, as a consequence of Termination or otherwise, have any obligation whatsoever including but not limited to obligations as to compensation for loss of employment, continuance or regularisation of employment, absorption or re-employment on any ground, in relation to any person in the employment of or engaged by the Concessionaire in connection with the Project, and the handback of the Project Facilities by the Concessionaire to ULB shall be free from any such obligation. It is clarified that only the Project Facilities of the Concessionaire shall be taken over and not the liabilities.

12.4 Accrued Rights of Parties

Notwithstanding anything to the contrary contained in this Agreement, Termination pursuant to any of the provisions of this Agreement shall be without prejudice to accrued rights of either Party including its right to claim and recover money damages and other rights and remedies which it may have in law or contract. The rights and obligations of either Party under this Agreement, including without limitation those relating to Termination Payment, shall survive the Termination but only to the extent such survival is necessary for giving effect to such rights and obligations.

ARTICLE 13

HANDBACK REQUIREMENTS

13.1 **Ownership**

Without prejudice and subject to the Concession, the ownership of the Project Facilities, including all modifications, renovations and improvements made therein by the Concessionaire, shall at all times remain with ULB.

13.2 Concessionaire's Obligations

(a) **Project Facility**

(i) The Concessionaire shall on the date of expiry of the Operations Period, hand back vacant and peaceful possession of the Project Facility including any tools, spares, inventory, machinery and all other movables required for its functioning to ULB free of cost and in good operable condition. However, the stock of derived products recovered after Processing the MSW till the date of expiry of the Operations Period including recyclables, compost, RDF etc. as on the expiry of the Operations Period shall be the property of the Concessionaire and the Concessionaire shall be at liberty to dispose of the said stocks in accordance with Applicable Laws. However, the arrangements for storage of such stocks till its disposal could be decided reasonably on mutual understanding between ULB and the Concessionaire

(ii) At least 3 (three) months before the expected expiry of the Operations Period a joint inspection of the Project Facility shall be undertaken by ULB, Independent Engineer and the Concessionaire. ULB/ Independent Engineer shall, within 15 (fifteen) days of such inspection prepare and furnish to the Concessionaire a list of minor and petty works/ jobs ("Handback Requirements"), if any, to be carried out so as to conform to the Construction Requirements and O&M Requirements. The Concessionaire shall promptly undertake and complete such works/jobs at least one month prior to the expected expiry of the Operations Period and ensure that the said Project

Facility continue to meet such requirements until the same are handed back to ULB.

(iii) ULB/ Independent Engineer shall, within 15 (fifteen) days of the joint inspection undertaken under preceding Sub-article prepare and furnish to the Concessionaire a list of items, if any, with corresponding distinctive descriptions, which are to be compulsorily handed back to ULB along with the said Project Facilities

(b) **Landfill Facility**

(i) During the Post Closure Period, ULB shall provide the Concessionaire necessary access to the Landfill Facility to fulfill its obligation for the period.

(ii) The Concessionaire shall after expiry of the Landfill Life maintain the Landfill Facility in accordance with the Post Closure Maintenance Plan.

(iii) Upon the expiry of the Post Closure Period, the Concessionaire shall hand back peaceful possession of the Landfill Facility to ULB free of cost and in good condition.

(c) The Concessionaire hereby acknowledges ULB's rights specified in Article 12.3 enforceable against it upon Termination and its corresponding obligations arising therefrom. The Concessionaire undertakes to comply with and discharge promptly all such obligations.

13.3 **ULB's Obligations**

In the event that the Concessionaire has not complied with its obligations with reference to Handback Requirements and/or O&M Requirements, the ULB shall, deduct amounts from the Performance Security in proportion to the activities/tasks outlined herein below:

(i) carrying out works/jobs listed under Article 13.2, which have not been carried out by the Concessionaire,
(ii) purchase of items, which have not been handed back to ULB in terms of Article 13.2, and
(iii) any outstanding dues, which may have accrued in respect of the Project during the Concession Period,

duly discharge and release to the Concessionaire, the Performance Security or balance therein after deductions in respect (i), (ii) and (iii) above, as the case may be, upon issuance of certificate by the Independent Engineer regarding compliance by the Concessionaire with the Handback Requirements.

ARTICLE 14

DISPUTE RESOLUTION

14.1 Amicable Resolution

(a) Save where expressly stated to the contrary in this Agreement, any dispute, difference or controversy of whatever nature between the Parties, howsoever arising under, out of or in relation to this Agreement, including those arising with regard to acts, decision or opinion of the Independent Engineer (the "**Dispute**") shall in the first instance be attempted to be resolved amicably in accordance with the procedure set forth in Sub-article (b) below.

(b) Either Party may require such Dispute to be referred to the Commissionaire of the ULB for amicable settlement. Upon such reference, the Commissionaire shall meet the Chief Executive Officer of the Concessionaire, at the earliest mutual convenience and in any event within 15 (fifteen) days of such reference to discuss and attempt to amicably resolve the Dispute. If the Dispute is not amicably settled within 15 (fifteen) days of such meeting, either Party may refer the Dispute to arbitration in accordance with the provisions of Article 14.2 below.

14.2 **Arbitration**

(a) Procedure

Subject to the provisions of Article 14.1, any Dispute which is not resolved amicably shall be finally settled by binding arbitration under the Arbitration Act. The arbitration shall be by a panel of three arbitrators, one to be appointed by each Party and the third to be appointed by the two arbitrators appointed by the Parties. The Party requiring arbitration shall appoint an arbitrator in writing, inform the other Party about such appointment and call upon the other Party to appoint its arbitrator. If within 30 days of receipt of such intimation, the other Party fails to appoint its arbitrator, the Party seeking appointment of arbitrator may take further steps in accordance with Arbitration Act.

(b) Place of Arbitration

The place of arbitration shall ordinarily be Lucknow but by agreement of the Parties, the arbitration hearings, if required, may be held elsewhere.

(c) English Language

The request for arbitration, the answer to the request, the terms of reference, any written submissions, any orders and awards shall be in English and, if oral hearings take place, English shall be the language to be used in the hearings.

(d) Enforcement of Award

The Parties agree that the decision or award resulting from arbitration shall be final and binding upon the Parties and shall be enforceable in accordance with the provisions of the Arbitration Act subject to the rights of the aggrieved parties to secure relief from any higher forum.

(e) Performance during Arbitration

Pending the submission of and/or decision on a Dispute and until the arbitral award is published, the Parties shall continue to perform their respective obligations under this Agreement without prejudice to a final adjustment in accordance with such award.

ARTICLE 15

REPRESENTATIONS AND WARRANTIES

15.1 Representations and Warranties of the Concessionaire

The Concessionaire represents and warrants to ULB that:

(a) it is duly organised, validly existing and in good standing under the laws of India;

(b) it has full power and authority to execute, deliver and perform its obligations under this Agreement and to carry out the transactions contemplated hereby;

(c) it has taken all necessary corporate and other action under Applicable Laws and its constitutional documents to authorise the execution, delivery and performance of this Agreement;

(d) it has the financial standing and capacity to undertake the Project;

(e) this Agreement constitutes its legal, valid and binding obligation enforceable against it in accordance with the terms hereof;

(f) the execution, delivery and performance of this Agreement will not conflict with, result in the breach of, constitute a default under or accelerate performance required by any of the terms of the Concessionaire's charter documents or any Applicable Laws or any covenant, agreement, understanding, decree or order to which it is a party or by which it or any of its properties or assets are bound or affected;

(g) there are no actions, suits, proceedings or investigations pending or to the Concessionaire's knowledge threatened against it at law or in equity before any court or before any other judicial, quasi judicial or other authority, the outcome of which may constitute Concessionaire Event of Default or which individually or in the aggregate may result in Material Adverse Effect;

(h) it has no knowledge of any violation or default with respect to any order, writ, injunction or any decree of any court or any legally binding order of any Government Agency which may result in Material Adverse Effect;

(i) it has complied with all Applicable Laws and has not been subject to any fines, penalties, injunctive relief or any other civil or criminal liabilities which in the aggregate have or may have Material Adverse Effect;

(j) subject to receipt by the Concessionaire from ULB of any amount due under any of the provisions of this Agreement, in the manner and to the extent provided for under the applicable provisions of this Agreement, all rights and interests of the Concessionaire in and to the Project Facilities shall pass to and vest in ULB on the Termination Date free and clear of all Encumbrances without any further act or deed on the part of the Concessionaire or ULB;

(k) no representation or warranty by the Concessionaire contained herein or in any other document furnished by it to ULB or to any Government Agency in relation to Applicable Permits contains or will contain any untrue statement of material fact or omits or will omit to state a material fact necessary to make such representation or warranty not misleading;

(l) no bribe or illegal gratification has been paid or will be paid in cash or kind by or on behalf of the Concessionaire to any person to procure the Concession;

(m) Without prejudice to any express provision contained in this Agreement, the Concessionaire acknowledges that prior to the execution of this Agreement, the Concessionaire has after a complete and careful examination made an independent evaluation of the Existing Assets, and the information provided by ULB, and has determined to its satisfaction the nature and extent of risks and hazards as are likely to arise or may be faced by the Concessionaire in the course of performance of its obligations hereunder; and

(n) The Concessionaire also acknowledges and hereby accepts the risk of inadequacy, mistake or error in or relating to any of the matters set forth above and hereby confirms that ULB shall not be liable for the same in any manner whatsoever to the Concessionaire.

15.2 **Representations and Warranties of ULB**

ULB represents and warrants to the Concessionaire that:

(a) ULB has full power and authority to grant the Concession;

(b) ULB has taken all necessary action to authorise the execution, delivery and performance of this Agreement;

(c) This Agreement constitutes ULB's legal, valid and binding obligation enforceable against it in accordance with the terms hereof; and

(d) There are no suits or other legal proceedings pending or threatened against ULB in respect of the Assets or the Project.

15.3 Obligation to Notify Change

In the event that any of the representations or warranties made/given by a Party ceases to be true or stands changed, the Party who had made such representation or given such warranty shall promptly notify the other of the same.

ARTICLE 16

DISCLAIMER

16.1 Disclaimer

(a) The Concessionaire acknowledges that prior to the execution of this Agreement, the Concessionaire has, after a complete and careful examination, made an independent evaluation of the Request for Proposal, Scope of the Project, Project Site, local conditions, and all information provided by the ULB/ C&DS, UPJN or obtained, procured or gathered otherwise and has determined to its satisfaction the accuracy, adequacy, correctness, reliability or otherwise thereof and the nature and extent of difficulties, risks and hazards as are likely to arise or may be faced by it in the course of performance of its obligations hereunder. Save as provided in Article 15.2, the ULB and C&DS, UPJN makes no representation whatsoever, express, implicit or otherwise, regarding the accuracy and/or completeness of any assessment, assumption, statement or information provided by it and the Concessionaire confirms that it shall have no claim whatsoever against the ULB and / C&DS, UPJN in this regard.

(b) The Concessionaire acknowledges and hereby accepts the risk of inadequacy, mistake or error in or relating to any of the matters set forth in Article (a) above and hereby acknowledges and agrees that the ULB shall not be liable for the same in any manner whatsoever to the Concessionaire, {the Consortium Members and their Associates} or any person claiming through or under any of them.

ARTICLE 17

MISCELLANEOUS

17.1 Assignment and Charges

(a) The Concessionaire shall not assign in favour of any person this Agreement or the rights, benefits and obligations hereunder, save and except with prior consent of ULB.

(b) The Concessionaire shall not create nor permit to subsist any Encumbrance over the Project Facilities, except with prior consent in writing of ULB, which consent ULB shall be entitled to decline without assigning any reason whatsoever.

(c) Restraint set forth in Sub-articles (a) and (b) above shall not apply to:

(i) liens/encumbrances arising by operation of law (or by an agreement evidencing the same) in the ordinary course of business of the Concessionaire:

(ii) Pledges/hypothecation of goods/ moveable assets, revenue and receivables as security for indebtedness, in favour of the lenders and working capital providers for the Project;

17.2 Interest and Right of Set Off

Any sum which becomes payable under any of the provisions of this Agreement by one Party to the other Party shall, if the same be not paid within the time allowed for payment thereof, shall be deemed to be a debt owed by the Party responsible for payment thereof to the Party entitled to receive the same. Such sum shall until payment thereof carry interest at 2% over and above SBI PLR % per annum from the due date for payment thereof until the same is paid to or otherwise realised by the Party entitled to the same, unless specified otherwise in this Agreement. Without prejudice to any other right or remedy that may be available under this Agreement or otherwise under law, the Party entitled to receive such amount shall also have the right of set off.

Provided the stipulation regarding interest for delayed payments contained in this Sub-article shall neither be deemed nor construed to authorise any delay in payment of any amount due by a Party nor be deemed or construed to be a waiver of the underlying breach of payment obligations.

17.3 Governing Law and Jurisdiction

This Agreement shall be governed by the laws of India. The Courts at Lucknow shall have jurisdiction over all matters arising out of or relating to this Agreement.

17.4 Waiver of immunity

Each Party unconditionally and irrevocably:

(a) agrees that the execution, delivery and performance by it of this Agreement constitute commercial acts done and performed for commercial purpose;

(b) agrees that, should any proceedings be brought against it or its assets, property or revenues in any jurisdiction in relation to this Agreement or any transaction contemplated by this Agreement, no immunity (whether by reason of sovereignty or otherwise) from such proceedings shall be claimed by or on behalf of the Party with respect to its assets;

(c) waives any right of immunity which it or its assets, property or revenues now has, may acquire in the future or which may be attributed to it in any jurisdiction; and

(d) consents generally in respect of the enforcement of any judgement or award against it in any such proceedings to the giving of any relief or the issue of any process in any jurisdiction in connection with such proceedings (including the making, enforcement or execution against it or in respect of any assets, property or revenues whatsoever irrespective of their use or intended use of any order or judgement that may be made or given in connection therewith).

17.5 Depreciation and Interest

17.5.1 For the purposes of depreciation under the Applicable Laws, the property representing the capital investment made by the Concessionaire in the Project shall be deemed to be acquired and owned by the Concessionaire. For the avoidance of doubt, the ULB shall not in any manner be liable in respect of any claims for depreciation to be made by the Concessionaire under the Applicable Laws.

17.5.2 Unless otherwise specified, any interest payable under this Agreement shall accrue on a monthly basis and from the respective due dates as provided for in this Agreement.

17.6 Liability for review of Documents, Reports and Development Plan

Except to the extent expressly provided in this Agreement:

(a) no review, comment or approval by the ULB or the Independent Engineer or Construction Supervisor of any documents including project agreement(s), periodic reports, financial statements, Development Plan, Drawings, O&M Plan, O&M Manual or any other documents submitted by the Concessionaire nor any observation or inspection of the development, operation or maintenance of the Project nor the failure to review, approve, comment, observe or inspect hereunder shall relieve or absolve the Concessionaire from its obligations, duties and liabilities under this Agreement, the Applicable Laws and Applicable Permits; and

(b) the ULB shall not be liable to the Concessionaire by reason of any review, comment, approval, observation or inspection referred to in Sub-article (a) above.

17.7 Waiver

(a) Waiver by either Party of any default by the other Party in the observance and performance of any provision of or obligations under this Agreement:

(i) shall not operate or be construed as a waiver of any other or subsequent default hereof or of other provisions or obligations under this Agreement;
(ii) shall not be effective unless it is in writing and executed by a duly authorised representative of such Party; and
(iii) shall not affect the validity or enforceability of this Agreement in any manner.

(b) Neither the failure by either Party to insist on any occasion upon the performance of the terms, conditions and provisions of this Agreement or any obligation hereunder nor time or other indulgence granted by a Party to the other Party shall be treated or deemed as waiver/breach of any terms, conditions or provisions of this Agreement.

17.8 Survival

Termination of this Agreement

(a) shall not relieve the Concessionaire or ULB of any obligations already incurred hereunder which expressly or by implication survives Termination hereof, and

(b) except as otherwise provided in any provision of this Agreement expressly limiting the liability of either Party, shall not relieve either Party of any obligations or liabilities for loss or damage to the other Party arising out of or caused by acts or omissions of such Party prior to the effectiveness of such Termination or arising out of such Termination.

17.9 Entire Agreement

This Agreement, Annexures and the Schedules together constitute a complete and exclusive statement of the terms of the agreement between the Parties on the subject hereof and no amendment or modification hereto shall be valid and effective unless such modification or amendment is agreed to in writing by the Parties and duly executed by persons especially empowered in this behalf by the respective Parties. All prior written or oral understandings, offers or other communications of every kind pertaining to this Agreement are abrogated and withdrawn. For the avoidance of doubt, the Parties hereto agree that any obligations of the Concessionaire arising from the Request for Proposal, as the case may be, shall be deemed to form part of this Agreement and treated as such.

17.10 Amendments, Modifications or Alterations

No amendments, modifications or alterations of or any additions to the terms and conditions of this Agreement shall be valid unless the same be in writing and agreed to by the Parties.

17.11 Notices

Unless otherwise stated, notices to be given under this Agreement including but not limited to a notice of waiver of any term, breach of any term of this Agreement and termination of this Agreement, shall be in writing and shall be given by hand delivery, recognised international courier, mail, telex or facsimile transmission and delivered or transmitted to the Parties at their respective addresses set forth below:

If to ULB:

The Commissioner,
–

If to the Concessionaire:

Or such address, telex number, or facsimile number as may be duly notified by the respective Parties from time to time, and shall be deemed to have been made or delivered:

(i) in the case of any communication made by letter, when delivered by hand, by recognised international courier or by mail (registered, return receipt requested) at that address, and
(ii) in the case of any communication made by telex or facsimile, when transmitted properly addressed to such telex number or facsimile number.

17.12 Severability

If for any reason whatsoever any provision of this Agreement is or becomes invalid, illegal or unenforceable or is declared by any court of competent jurisdiction or any other instrumentality to be invalid, illegal or unenforceable, the validity, legality or enforceability of the remaining provisions shall not be affected in any manner, and the Parties shall negotiate in good faith with a view to agreeing upon one or more provisions which may be substituted for such invalid, unenforceable or illegal provisions, as nearly as is practicable. Provided failure to agree upon any such provisions shall not be subject to dispute resolution under this Agreement or otherwise.

17.13 No Partnership

Nothing contained in this Agreement shall be construed or interpreted as constituting a partnership between the Parties. Neither Party shall have any authority to bind the other in any manner whatsoever.

17.14 Third Parties

This Agreement is intended solely for the benefit of the Parties and their respective successors and permitted assigns and nothing in this Agreement shall be construed to create any duty to, standard of care with reference to, or any liability to, any person not a Party to this Agreement.

17.15 Successors and Assigns

This Agreement shall be binding upon, and inure to the benefit of the Parties and their respective successors and permitted assigns.

17.16 Language

All notices required to be given under this Agreement and all communications, documentation and proceedings which are in any way relevant to this Agreement shall be in writing and in English language.

17.17 Exclusion of Implied Warranties etc.

This Agreement expressly excludes any warranty, condition or other undertaking implied at law or by custom or otherwise arising out of any other agreement between the Parties and any representation by any Party not contained in a binding legal agreement executed by the Parties.

17.18 Waiver of Sovereign Immunity

Each Party hereto unconditionally and irrevocably:

(a) agrees that the execution, delivery and performance by it of this Agreement and all other agreements, contracts, documents and writings relating to this Agreement constitute private and commercial acts and not public or governmental acts;

(b) consents generally in respect of the enforcement of any judgment against it in any proceedings, in any jurisdiction to the giving of any relief or the issue of any process in connection with such proceedings including without limitation the making, enforcement or execution against or in respect of any property irrespective of its use.

17.19 Counterparts

This Agreement may be executed in two counterparts, each of which when executed and delivered shall constitute an original of this Agreement but shall together constitute one and only the Agreement.

IN WITNESS WHEREOF THE, PARTIES HAVE EXECUTED AND DELIVERED THIS AGREEMENT AS OF THE DATE FIRST ABOVE WRITTEN.

SIGNED SEALED AND DELIVERED
For and on behalf of ULB by

Name:
Designation:

SIGNED, SEALED AND DELIVERED
For and on behalf of the Concessionaire by:

Name:
Designation:

In the presence of

1)

2)

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SCHEDULE A

CONCESSION AREA DETAILS

The Concession area is the area falling within the jurisdiction of the _____ Municipal Corporation. The map showing the boundary of the Concession Area is enclosed as Enclosure 1 to this schedule.

SCHEDULE B

WORKSHOP SITE

1. Name of the Site:

2. Location of the Site:

The Topographic Survey of the site is enclosed as Enclosure 1to this schedule.

SCHEDULE C

MSW PROCESSING SITE

1. Name of the Site:

2. Location of the Site:

3. Area of the Site:

The Topographic Survey of the site is enclosed as Enclosure 1to this schedule.

SCHEDULE D

LIST OF EXISTING ASSETS

SCHEDULE E

LIST OF NEW ASSETS

Based on the Development Plan, the Concessionaire shall procure the following New Assets for implementing collection and transportation part of the Project in accordance with this Agreement:

Sl. No.	**Assets**	**Specifications**	**Number**
1.	Primary collection bins		
2.	Primary storage bins		
3.	Waste bins		
4.	Loading equipments		
5.	Transport vehicles		
6.	Transfer stations		
7.	Complaint handling center		

SCHEDULE F

CONSTRUCTION REQUIREMENTS

The Construction Requirements to be complied by the Concessionaire has been laid down in this Schedule. The Construction Requirements under this schedule has been divided in the following sections:

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Glossary

TERI	The Energy Research Institute
JnNURM	Jawaharlal Nehru National Urban Renewal Mission
MoUD	Ministry of Urban Development, Government of India
MoEF	Ministry of Environment & Forests, Government of India
CDP	City Development Plan
MSW Rules 2000	Municipal Solid Waste Management & Handling Rules, 2000
MSWM	Municipal Solid Waste Management
CBO	Civic Body Organization
RWA	Resident Welfare Association
RMT	Running Metres of Road Length
C/N Ratio	Carbon Nitrogen Ratio
HDPE	High Density Poly Ethylene
LDPE	Low Density Poly Ethylene
CDM	Clean Development Mechanism
MIS	Management Information System
GIS	Geographic Information System
EIA	Environment Impact Assessment

EXECUTIVE SUMMARY

Introduction

With the 74th amendment of the Constitution of India in 1992, municipal authorities in the country have been recognized as a third tier of government. The 12th schedule of the Constitution has laid down the functions envisaged to be performed by the municipal authorities one among those functions is solid waste management. It is an obligatory duty of municipal authorities in the country to keep cities/towns clean and provide a good quality of life to the citizens. However, the services provided by the municipal authorities are outdated and very inefficient causing serious problems of health and environment. Problems of solid waste management are growing with rapid urbanization and change in the lifestyle of the people. The situation is becoming critical with the passage of time.

Magnitude of the Problem of Solid Waste Management

India has 4378 cities and towns which generate waste in the range of 0.2 kg and 0.6 kg per capita per day amounting to 115000 MT of waste per day i.e. 42 million tons annually. The Energy Research Institute (TERI) has estimated that the waste generation will exceed 260 million metric tons by 2047 which speaks volumes of the problems that urban areas are going to face in coming decades in managing their waste.

Urbanization in Uttar Pradesh

Uttar Pradesh is the most populated state in the country with seven cities above 1 million population. The state is therefore, facing a challenge of providing essential infrastructure in urban centers to keep pace with population growth. Solid waste management is one among the major challenges faced by the state governments in urban areas.

Launch of JnNURM

This is a major infrastructure development initiative undertaken by Government of India from December 2005 to improve essential infrastructure in 35 one million plus cities, state capitals and certain important cities of India (63 cities). The city of Varanasi is among one million plus populated cities covered under JnNURM and are eligible to get financial support to improve the systems of solid waste management.

City Profile

Varanasi city has an area of 79.79 Sq. Km. Until 1991 the area of the City was only 56.65 Sq. Km. Varanasi has a population of 1202443 as per 2001 census. The city

has grown six fold in last seven decades.

The population projections for the city of Varanasi have been carried out by three methods while preparing the City Development Plan, the details of which are given in the table below.

Population Projections

The population projections for the City of Varanasi have been carried out by three methods and a comparison with the population projection in the CDP is shown in the table below:

Population projections

Population Projection in the CDP			
Methods	**2011**	**2021**	**2031**
Geometric	1489931	1846154	2287544
Incremental increase method	1995366	3311161	5494624
Exponential	1576734	2067531	2711102
Average	**1687344**	**2408282**	**3497757**
Population Projection used in the DPR			
Methods	**2011**	**2016**	**2021**
Geometric	1514365	1699471	1699471
Incremental increase method	1371777	1456445	1541112
Arithmetic	1371777	1456445	1541112
Average	**1419307**	**1537453**	**1663142**

Population projections as in the DPR on Water Supply for Varanasi City approved by Government of India.

S. No.	**Methods**	**2010**	**2025**	**2040**
1	Arithmetic	1330300	1543500	1756700
2	Geometric	1493100	2142100	3073000
3	Incremental increase method	1346500	1620500	19737000
4	Semilog Graphical Method	1600000	2280000	3300000
5	Area Density Method	**1666100**	**2473700**	**3317900**

Calculations done by area density methods have been adopted in the DPR prepared for Water Supply and approved by CPHEEO under JNNURM. A Floating population of 50,000 is also considered and has been taken in DPR for Varanasi city.

Therefore, population projections based on this figure has been used for design of treatment and disposal facility in this DPR.

Waste Generation

The city at present generates **600 MT** of waste per day at the rate of 0.46 Kg per capita per day. With the increase in population the waste generation is projected to reach **735 MT/day by 2011**.

With a view to come to a correct figure of waste generated per day, an exercise was undertaken to weigh the waste transported to dump site. Weighing was carried out for seven consecutive days, which revealed that average waste generation rate is 480 MT/Day.

It was estimated that 25% of waste generated in the city is not collected for various reasons. This takes the waste generation rates to 600 MT/day which needs to be taken into consideration for planning the systems of solid waste management.

Average per capita waste generation in the city comes out to be **0.410 Kg per capita per day.**

Taking into account the religious, industrial and commercial activities in the city of Varanasi and its future potential it is desirable to assume additional 1.5% increase in the quantity of waste generation each year. Therefore a realistic waste generation has been projected as shown in Table below for the purpose of this DPR.

Projected Waste Generation

Year	**Population**	**Per capita waste generation**	**Waste Generation Based on Population MT/Day**	**After Adding 1.5% increase due to change in life style**
2001	1202443	0.410	493.00	500.40
2010	**1716100**	**0.410**	**703.60**	**714.16**
2025	2523700	0.410	1034.72	1050.24
2040	3367900	0.410	1380.84	1401.55

As seen from the table above the projected waste generation for 2010 is 714.16 MT/Day. Based on this the projected waste generation of 2011, the design period of this DPR, will be 735 MT/day.

Waste Composition

We undertook a study to determine the composition of waste generated in the city in three different economically and geographically different areas. This was done by collecting the waste from 200 households in each area and street sweepings collected at the secondary storage point from the restricted area conforming to same 200 households.

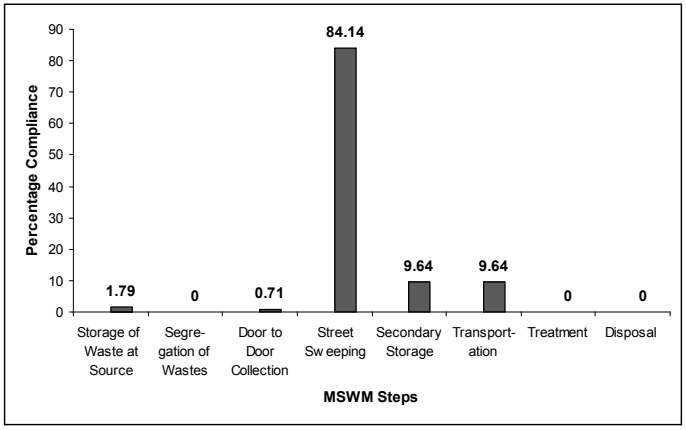
Overall composition of waste generation in the city

Biodegradable	Recyclable	Other Waste
51.25%	15.30%	33.45%

Composition of recyclable waste					
Paper	Polythene	Plastics	Glass	Metals	Miscellaneous
32.8	25.6	7.3	5.7	5.8	22.8

Status of Solid Waste Management in Varanasi

Detailed study of the existing situation of solid waste management in Varanasi is carried out. The city generates 600 MT of waste per day out of which 75% is collected daily in an unscientific manner. The waste generated is likely to increase up to 735 MT/day by 2011. The composition of waste generated is depicted in the graph above.



It has revealed that no special efforts have been made to educate the people not to litter and store the waste at source, 70% of the households, shops and establishments continue to throw the waste on the streets. The segregation of recyclable waste is non existent. Door to door collection has not been introduced in any part of the city. The situation of street sweeping is reasonably good. 70% of the streets are cleaned everyday.

Secondary storage system continues to be an eyesore. There are insufficient numbers of waste storage depots and majority of them are open and unhygienic. Only 20 masonry "dhalos", 27 open waste storage sites and 65 containers have been

provided for secondary storage. The depots are not in synchronization with the primary collection system and multiple handling of waste is practiced. Transportation of 75% of waste is done on a day to day basis but 90% of the vehicles are not covered. The situation of treatment and disposal of waste is extremely poor. Municipal Corporation does not do any treatment or scientific disposal of waste. The entire waste which is over 600 MT a day is disposed of haphazardly in Varuna tributary of river Ganges and on a private nursery land in the City. The waste is neither spread nor covered. It is allowed to decay on site. It is seen from the graph above, that a lot is required to be done and a strategy has to be evolved to ensure that the deficiencies are met and compliance of all the 7 steps is made expeditiously.

Special Problems of Varanasi

Varanasi has several problems very specific to the city. The city has as many as 85 ghats which are frequented by a large number of pilgrims and tourists. Several types of religious ceremonies are performed at these ghats and these ceremonies generate variety of wastes which are traditionally immersed in the holy river flowing next to ghats. Flowers form a major component of such waste; they keep floating and pollute the river. The Municipal Corporation makes special efforts to remove these flowers through boats. There are two major cremation ghats namely HARISHCHANDRA GHAT and MANIKARNIKA GHAT where on an average 125 bodies are cremated each day using traditional firewood. Ash generated in this process finds its way in the holy river Ganges. Several people live very close to the ghats. They are poor and have no toilet facilities. They defecate on the ghats and create serious problems of health and sanitation. Washer men and cattle breeders also carry on their activities on the ghats and in the river creating unsanitary conditions and cause pollution.

Preparation of DPR

This detailed project report is prepared to facilitate implementation of MSW Rules 2000 expeditiously in the city by modernizing the systems of solid waste management with active community, NGO and private sector participation.

Approach and Methodology

In keeping with the dynamic approach of the commissioner, detailed consultations were held with all stakeholders who included all the supervisory staff dealing with solid waste management, Health Officers, Deputy and Additional commissioners and various Departmental Heads. Detailed interactions were also held with Honourable Mayor and members of the executive council of the corporation. Discussions with these stakeholders were carried out to understand their perceptions of solid waste management and learn their views on the systems of waste management which can be introduced in the city to tide over the difficulties encountered by them in managing municipal solid waste in the city. All aspects of solid waste management were

studied and discussed in details and their observations noted.

The project report aims at ensuring:

1. No littering of waste on the streets
2. Segregation of recyclable and biodegradable waste at source of waste generation
3. Door to door collection of both types of waste on a day to day basis from all households, shops and establishments as well informal settlement on day to day basis
4. Street sweeping in all the areas including informal settlements using improved tools
5. Abolition of open waste storage sites and "dhallaos" ensuring secondary storage in two types of covered containers. Green container for biodegradable waste and black containers for storage of street sweepings
6. Transportation of biodegradable and inert street sweepings in covered hydraulic vehicles avoiding multiple and manual handling of waste
7. Setting up two transfer stations to economize the cost of transportation using large hauling vehicles
8. Setting up a microbial compost plant with a scope of waste to energy through private sector investments.
9. Construction of an engineered landfill in a phased manner for the scientific disposal of waste keeping in mind the future requirement of over 20 years.
10. Remediation through leveling, shifting, compacting, grading and closure as per MSWM rules of abandoned dumping grounds in the city.
11. Involving community, NGO and private sector in managing the waste scientifically and cost effectively.
12. Introducing the element of cost recovery through user fees, carbon credits and improves the finances through financial discipline.

For meeting the above objectives

1. It is proposed to ban the littering of waste on the streets by **introducing storage of waste at source in a segregated manner**, **introducing the system of door to door collection** through containerized handcarts/tricycles and transferring the domestic waste directly in to green containers that are proposed to be placed at short distances in the entire city to ensure that this organic matter gets collected separately and taken to the treatment plant.

2. The **street sweepings are proposed to be collected separately and directly transferred** into black containers kept along side the green containers.

3. **The transportation of waste is planned through covered hydraulic vehicles in such a way that the green containers are lifted daily and the black containers every once a week when they are about to be full and directly**

taken to the transfer stations.

4. **It is proposed to set up two transfer stations of a design where waste could be directly tipped into a large hauling vehicles taken to the treatment plant.**

5. **The entire system is well synchronized avoiding multiple and manual handling of waste.**

6. **Microbial composting of 375 MT organic matter** scientifically at the proposed composting plant.

7. **Scientific disposal of inerts and rejects** from the treatment plant at an engineered landfill is proposed.

8. Besides, all **existing dumpsite are proposed to be closed scientifically.**

Designing of 375 TPD Compost Plant

Given the technological options available for processing of municipal solid waste at the present juncture and keeping in view the composition of waste of Varanasi city, **microbial composting of organic/food and biodegradable waste is recommended**. If private sector comes forward to simultaneously set up waste to energy plant along with compost plant entirely at its own cost, it may be considered on merits.

Although the generation of waste is 600 TPD, composting project which is designed for 375 MT/Day only as 10% to 15% of waste which is recyclable will get segregated at source and another 25-30% waste in the form of street sweeping and construction waste will not be allowed to be deposited in green containers and instead will be taken directly to the disposal site reducing the overall quantity of waste going to the compost plant to about 51% of waste that is about 376 MT of waste. The flower waste is proposed to be collected separately and converted to compost in the flower composting machines. This reduces the waste coming to compost plant to **372 MT/Day**. Keeping in view the increase in the quantity of waste over a period of next 5 years and decrease of waste on account of better segregation a plant with the capacity of 375 TPD is proposed.

A Compost plant with a capacity of 375 TPD is proposed for Varanasi in this DPR. A concrete yard is proposed in an area of 5 acres, as availability of land is limited. In order to get the waste processed (reducing the volume, weight etc and screening for separating non degradable), over a period of 30 days instead of 60 days, the processing machinery components are designed to treat more than 300 TPD of waste. While separating the non degradable the quantity of rejects generated will be accumulating over a vast area therefore the processing equipments like Pay loaders, Tippers, Tractors etc, have also been

given priority so that the treatment of waste is continuous and accumulation of waste is avoided there by reducing the level of pollution.

It is planned that the resultant non degradable inert rejects will be directed on a day to day basis to the land fill site.

It is being said that marketing of organic manure is a Herculean task. This is because of non production of good quality organic manure at an affordable price to the farmers. The use of chemical fertilizers for the past more than 50 years has rendered cultivable lands as sick soils. Therefore there is very good potential for marketing organic manure to improve the health of the soil provided the quality and the price are within the acceptable level. This project aims at producing good quality of manure and marketing the same at an affordable price.

The marketing network and promotional programmes which are essential for a successful marketing will however have to be implemented. Composting activity although is said to be a non profit making venture but it has been proved by a few composting industries that breaking even or making marginal profits is possible with dedicated efforts.

The proposed compost plant will comply with municipal solid waste (M&H) rules 2000 and appropriately address the environmental issues. The costing of the civil, mechanical components and equipments has been detailed in the relevant chapter.

Design for Engineered Landfill and Closure of Old Dumps

The total waste generated in the city presently is 600 MT/day. Out of this the organic waste collected from the door step from the house holds, vegetable markets, hotels etc will be taken to the Processing site and inerts will be taken to the disposal site. After the composting process is over, the rejects will also be taken to the landfill. The inerts and rejects that are expected to reach the landfill are assumed at 40% of the total waste, which works out to 240 MT/day. There is a need to construct 7 landfill cells (3 year life each) to last for 20-25 years. The total area of land required for composting and Landfilling for 20-25 years would be about 225 acres. The Municipal Corporation therefore needs a site having an area of 250 acres or more.

This land requirement for the compost plant and landfill site is calculated keeping in mind the need of next 20 - 25 years with a provision of buffer area to minimize the NIMBY syndrome. **However, the land available with the Municipal Corporation is only about 48.13 Acres so the requirement of land has been split in to two phases. Initially the compost plant is proposed to be constructed on 12 Acres of land and two cells for the landfill which will last for about 6 years are proposed to be constructed in phase 1 at the land available with the Municipal Corporation.**

The cost estimate is made accordingly for the construction of compost plant and two cells of the landfills. It is suggested that the Corporation, in the mean time, should look for suitable parcel of At least 125 Acres land for future which they may acquire or bring in private sector to construction and operate waste disposal facility on their own land on the concept of tipping fees. This DPR is now restricted to 48 Acres of land only for construction of treatment and disposal facility in Phase I.

The Corporation has offers from private sectors to take up the operation and maintenance of the compost plant as well as setting up of land fills on their own land which would be taken up by the Corporation in phase II as soon as the private sector comes up with concrete proposal before the Corporation.

Closure of old dumps

While considering the need of closure of old dump sites, it is observed that waste dumping has been done at several places along the roads, lanes, open lands, bridges and rivers. This practice is going on for a long period resulting into heaps of waste. These waste heaps sometimes cover large area, while some are very small open dumps. This waste spread all over the city causes nuisance and health hazards to the people. **The total number of open dumps either abandoned or in use is 74. All these open dumps are within the city limits. Of these 35 sites are on Private lands and therefore not considered in this proposal. Some of the 39 sites are clubbed along with the nearby sites to reduce the number to 28. Of these 21 are categorized in Alternative "A", while the remaining 7 are categorized as Alternative "B", the details of which are provided in this report.**

Strategy to Take Care of Open Dumps

All open dumps in the city have been differentiated under 3 categories as follows,

1. Private land dumping
2. Waste on which covering of 600 mm compacted soil to be done (Alternative" A")
3. Waste on which proper closure with bund on 3 or 4 sides to be done (Alternative "B")
4. Waste on the banks of river Ganga is transported within 5 km and capped with 600 mm compacted soils. (Alternative "C")

Waste is being dumped on private lands e.g. all open dumps in Sigra ward are on private land. Few dumps in Nagwa ward, Jaitpura ward, Sicrol ward and Sarnath ward are also on private land. In some cases, the dumping has been done with the consent of the land owners. They will not allow the waste to be removed. Thus government can not be involved in handling of waste on such area. Hence dumps on

all Private lands are left untouched. These dumps are 35 in number.

At some places in Aadampur, Sicrol ward and Sarnath ward, waste is being dumped having large dimensions. At such places alternative "A" is to be adapted. In this alternative the waste is to be given a proper slope of approximately 1V:2.5H. To achieve this slope, some amount of waste will have to be dozed in cut and fill to get the required stable slopes. After getting the required slope, this waste is to be covered using 600 mm compacted soil.

The estimation for this alternative is attached separately. This type of temporary closure will help in minimizing the amount of leachate formed as soil layer will help to reduce the amount of water percolating the waste. Also it will help in improving aesthetic appearance and help in preventing the nuisance created by flies, animals and also bird menace. The total number of such dumps is 20 in number.

For remaining places in Nagva ward, Jaitpura, Adampur, Sicrol ward alternative "B" is adopted as most of the places are covered with large amount of waste along the small bridges. From these places, the waste is to be closed with proper closure method with geomembrane and provision for gas vents. At some places where the dumps are very small in size, the waste is to be hauled to the nearest larger open dump.

On the banks of the river Ganga, especially on Naya ghat, Pralhad ghat, Sakka ghat and Telliyanala ghat waste is being dumped. This waste will have to be picked up manually into a truck and transported to a suitable site within 5 Km. This waste will be compacted and capped with 600mm thick soil thus reducing the site to only 1 in number. This is categorized as Alternative "C"

All the alternatives are proposed to eradicate the problem of open dumping in the city, thus keeping the city clean. This will minimize public nuisance, foul odor, animal and bird menace. It will also minimize the land and water pollution. All these alternatives are proposed for the waste dumps in the city.

Requirement of Tools, Equipments, Vehicles & Finances etc.

The need of tools, equipments and vehicles as well as for the construction of compost plant and the engineered landfill site has been worked out in details and their designs and cost estimates have been prepared and incorporated in this report.

Requirement of tools, equipment, vehicles and funds for the procurement of the same as well as for the construction of treatment and disposal facility and remediation of old waste dumps.

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Requirement of tools, equipment, vehicles and funds for the procurement of the same as well as for the construction of treatment and disposal facility and remediation of old waste dumps

Sr. No.	Item of Expenditure	Quantity Required	Quantity Existing	Shortfall	Cost per unit in Rs.	Total Expenditure (in Lakhs)
1	Containerised Tricycle for door to door collection of waste with 6 LDPE Containers	800	0	800	10500	84.00
2	Pushcarts with 6 bins for door to door collection of waste from narrow lanes (MS Steel frame with LDPE Containers)	300	0	300	7875	23.63
3	Containerized Tricycles for collecting street sweepings with LDPE Containers	888	0	888	10500	93.24
4	Pushcarts with 6 bins for collecting street sweepings from narrow lanes	484	0	484	7875	38.12
5	Seamless handcarts for drain cleaning	400	400	0	0	0.00
6	Litter bins (40Litre Capacity)	500	0	500	1400	7.00
7	7Cubic metre green containers	150	0	150	57000	85.50
8	3.5Cubic metre green containers	189	65	124	35000	43.40
9	3.5Cubic metre black containers for street sweeping	239	0	239	35000	83.65
10	Dumper Placer Vehicles (10Ton GVW) having twin bin lifting device with hyraulic cylinders and high pressure	27	12	15	1100000	165.00
11	Dumper Placer Vehicles with hyraulic cylinders and high pressure	28	0	28	1100000	308.00
12	4.5Cubic metre skip containers for storing and transporting construction debris	30	0	30	40000	12.00
13	Skip Lifters Machines	3	0	3	1050000	31.50
14	Hopper/Small Pickup Vans	20	22	0	0	0.00
15	Large Hauling Vehicles for Transfer Station (27Cubic Metre)	19	2	17	2275000	386.75
16	Hotel waste collection vans	6	6	0	0	0.00
17	Garden waste collection vans	5	5	0	0	0.00

Sr. No.	Item of Expenditure	Quantity Required	Quantity Existing	Shortfall	Cost per unit in Rs.	Total Expenditure (in Lakhs)
18	Asphalting of flooring under the containers	577	0	577	13000	75.01
19	Construction of Simple Ramp Model Transfer stations with weighing bridge, compactors and washing facility	2	0	2	15209090	304.18
20	Flower composter machine	4	0	4	1500000	60.00
21	Compost Plant of 375MT/Day Capacity with Equipments	1	0	1	130600000	1306.00
22	Upgradation of Maintenance Workshop for repair and maintenance of Vehicles	1	0	1	2500000	25.00
23	Closure of existing open waste dumps	1	0	1	20,749,070	207.49
24	Cost of Landfill Construction including Landfill Equipments	1	0	1	136,298,002	1362.98
Capital Costs						**4702.44**
25	Contingency (3% of Capital Costs in DPR)					141.07
Total Capital Costs						**4843.52**
26	**Cost for establishing project implementation mechanism and for consultancy charges towards project preparation at 0.5% of Total Project Cost**					**24.22**
Project Cost						**4867.736**
Reimbursable						
26	Public Awareness IEC, Training & Capacity Building/ Exposure Visits (details provided in IEC Chapter)					100.000
27	Cost of Preparation of Detailed Project Report (1.5% of Capital Costs in DPR)					70.54
28	Monitoring, Supervision, Project Management Costs (5% of Capital Costs in DPR)					235.12
Total Reimbursable Amount						**405.66**

**** Note:***

1. ***The above rates are inclusive of transportation costs.***
2. ***Cost of commissioning is also included in the cost.***
3. ***These rates are valid for a period of one year.***

Annual Requirement of funds for repairs and replacement of tools, equipment and treatment and disposal facility

Sr. No.	Item of Expenditure	Quantity Required	Cost per unit in Rs.	Total Expenditure (in Lakhs)	Annual cost of repair (2007 value) in lakhs	Expected life of equipment and vehicles in years	Proportionate annual cost of replacement in lakhs
1	Containerised Tricycle for door to door collection of waste with 6 LDPE Containers	800	10500	84	4.2	3	28.00
2	Pushcarts with 6 bins for door to door collection of waste from narrow lanes (MS Steel frame with LDPE Containers)	300	7875	23.625	1.18125	3	7.88
3	Containerized Tricycles for collecting street sweepings with LDPE Containers	888	10500	63	3.15	3	21.00
4	Pushcarts with 6 bins for collecting street sweepings from narrow lanes	484	7875	23.625	1.18125	3	7.88
5	Seamless handcarts for drain cleaning	400	3500	14	0.7	3	4.67
6	Litter bins	500	2000	10	0.5	3	3.33
7	7Cubic metre green containers	150	57000	85.5	4.275	5	17.10
8	3.5Cubic metre green containers	189	40000	75.6	3.78	5	15.12
9	3.5Cubic metre black containers for street sweeping	239	35000	83.65	4.1825	5	16.73
10	Dumper Placer Vehicles (10Ton GVW) having twin bin lifting device with hyraulic cylinders and high pressure	27	1100000	429	21.45	8	53.63
11	Dumper Placer Vehicles with hyraulic cylinders and high pressure	28	1100000	308	15.4	8	38.50

Sr. No.	Item of Expenditure	Quantity Required	Cost per unit in Rs.	Total Expenditure (in Lakhs)	Annual cost of repair (2007 value) in lakhs	Expected life of equipment and vehicles in years	Proportionate annual cost of replacement in lakhs
12	4.5Cubic metre skip containers for storing and transporting construction debris	30	40000	12	0.6	5	2.40
13	Skip lifters	3	1050000	31.5	1.575	8	3.94
14	Hopper/Small Pickup Vans (1Cubic Metre capacity)	20	200000	40	2	5	8.00
15	Large Hauling Vehicles for transfer station (27 Cubic Metre)	19	2275000	432.25	21.6125	10	43.23
16	Hotel waste collection vans (3 MT)	6	800000	48	2.4	8	6.00
17	Garden waste collection vans	5	900000	45	2.25	8	5.63
18	Asphalting of flooring under the intermediate storage containers	577	13000	75.01	3.7505	5	15.00
19	Transfer stations	2	15209090	304.1818	15.20909	30	10.14
20	Flower compost machine	4	1500000	60	3	10	6.00
21	Upgradation of Maintenance Workshop for repair and maintenance of Vehicles	1	2500000	25	1.25	10	2.50
23	Continuous IEC Activities	1	1000000	10	10	NA	0.00
		Total			**123.64709**		**316.65**
Total Cost of Requirement of funds for Repair, Maintenance and Replacement							**440.30**
Annual Cost of Requirement of funds for Repair and Maintenance in Rs. Crores							**Rs. 1,23,64,709/-**
Proportionate annual cost of replacement of equipment/vehicles							**Rs. 3,16,65,000/-**

As seen from the table above that annually **Rs. 123.65 lakhs** would be required for repairs and maintenance of the tools, equipment and vehicles. Beside this **Rs. 316.65 lakhs** would have to be set apart towards the sinking fund for the replacement of the vehicles and equipment at the end of their useful life. Besides, a tipping fee @ Rs. 200 per MT for nearly 240 MT per day will have to be paid which will amount to **Rs. 175.20 lakhs** annually. We have not included the cost of operations and management of composting plant as it would be run by the private party.

Above mentioned funds will have to be found each year besides **Rs. 1,909 Lakhs** towards salaries and allowances of the existing staff and **Rs. 225 Lakhs** towards fuel cost. The cost of escalation will have to be added as per the market conditions prevailing at a relevant time.

The corporation will not have to spend on operation and maintenance of door to door collection of waste as it would be done through Public Private Partnerships on cost recovery basis. Private party/NGOs/RWAs shall be responsible for operation and maintenance of services.

Funding for Capital Expenditure

As per the estimates of the cost of procurement of tools, equipment, vehicles and construction of treatment and disposal facilities, the corporation would need **Rs. 4843.52 Lakhs** to put the entire system in place including the cost of closure of old abandoned and current open dumps. In this provision for IEC activities (1.5% of capital costs), Supervision and Management (5% of capital costs) and contingency (3%) has been kept as per the guidelines for the DPR for Solid Waste Management for JNNURM cities. This makes the total requirement of funds as **Rs. 4867.736 Lakhs.**

As the time limit for implementing MSWM Rules 2000 is already over in December, 2003, the corporation, therefore, need to procure all the tools, equipment, vehicles and construct treatment and disposal facility very expeditiously and put the system in place within a period of less than 2 years. The project cost should, therefore, be spread in two equal components of **Rs. 2433.86 Lakhs** in the year 2007 and 2008.

Cost Sharing under JnNURM

As the City of Varanasi is a one million plus covered under JnNURM scheme, it is entitled to get 50% grants from Government of India, 20% grant from the state government.

Private sector participation has been suggested in areas of construction of transfer station, treatment and disposal facilities. Under such an arrangement the Municipal Corporation will provide the services of door to door collection, street sweeping,

secondary storage, transportation of waste up to the transfer station and the private parties will be involved to construct and operate the transfer station, treatment & disposal facilities through contracting mechanism. The private party will contribute 30% of the cost share of Municipal Corporation towards the treatment and disposal facilities and the remaining shall be contributed by Varanasi Municipal Corporation.

Total Cost of the project in Rs. Crores	Cost Sharing by Government of India Rs. Crores	Cost sharing by State Government Rs. Crores	Cost sharing by Municipal Corporation Rs. Crores
48.67	**24.335**	**9.734**	**14.601**

Whereas, the municipal corporation may find the financial support under the JnNURM scheme for capital investment; but it will have to find funds for maintaining the services in a sustainable manner and ensure that all the facilities created are maintained effectively and adequate funds are made available for the same. Solid Waste Management is one of the most essential services and needs to be provided satisfactorily so that health and sanitation is maintained and the environment is well protected. It is an obligatory duty of Municipal Corporation. It cannot escape the responsibility of providing this basic service on the grounds of paucity of funds. The Municipal Corporation has, therefore, to find or raise funds to maintain the minimum level of service recommended in this report in Finance Chapter.

Cost Recovery through User Fees, Carbon Finance/CDM

The municipal authorities in the country generally do not provide door to door waste collection service and do not levy any charges exclusively for solid waste management as solid waste management services are funded from the general taxes levied by the municipal authorities. Now when door to door collection system is being introduced through private sector participation, it is essential to seriously consider the cost recovery for this personal service rendered. This can be best done by levy of user fees from the beneficiaries by prescribing different rates for different categories of waste generators.

The following rates are suggested.

Category of beneficiary	Monthly user fee
Low income group households	Rs. 20/month
Households other than low income group	Rs. 30 – 50 /month
Normal Shops and establishments	Rs. 75 to 200/month
Hotels, large commercial complexes, large institutional buildings	Rate to be levied looking at the quantity of waste generated. (average 300/month)

Municipal Corporation should introduce user fee to meet the cost of service from door step without putting any burden on the municipal corporation. Agreement should be signed with NGOs/Private Parties to collect the amount of user fee as proposed above from households/shops/establishments. The NGO/Private party in turn should be asked pay a fixed amount to Municipal Corporation per month and wages to the work force directly. Income from such an arrangement would enable the Municipal Corporation to recover part cost of tools and equipments like tricycles, bins, containers etc., provided by corporation. This effort is likely to generate an income of Rs. 17.7 lakhs per month taking an average sharing of profit at the rate Rs. 10/- per household/shop/establishment per month. This source would thus generate income of Rs. 2 crores per annum.

As composting plant would be operated and managed by the private party, the municipal corporation should negotiate at least 25% of the profit share in lieu of capital investments on construction of compost plants and equipments to be made by the central government/state government and Municipal Corporation. Thus 25% of 99 lakhs (Calculated profit per year) i.e. 24.75 lakhs could be received by the Corporation. Besides this the corporation received Rs. 8,07,63,388 as funds from the 12th Finance commission out of which Rs.1,80,17,748 has been utilized. The balance amount of Rs. 6,27,45,640 is available with the municipality.

The corporation should further explore to raise finances through CDM route, where as per the estimates of the World Bank experts, 10 USD can be realized per 2 Tonnes of waste per day. Considering 600 tonnes of waste per day in 2006 and 735 tonnes by 2011. An average quantity of waste can be put as 665MT per day for availing of carbon finance at the rate 5 USD per tonne per day. An amount of Rs. 5.00Crores can be realized through CDM route. The municipal corporation can make up a sizeable cost recovery through user fees, selling of compost and Carbon finance. If need be, the corporation can divert more funds from its annual budget for SWM by improving the financial management of the city. The Municipal Corporation could raise the finances from the above three sources as under:-

Sr.	Source of Income	Income in Rs. Per annum
1	Share from user fees	212 lakhs
2	Sharing of the profits from compost plant	24.75 lakhs
3	Carbon Finance	500 lakhs
	Total	**736.75 lakhs**

The above income would be sufficient to meet the cost of operation and maintenance of tools and equipments, the cost of tipping fee for the landfill and cost of replacement of the tools and equipment at the end of their useful life which is estimated at 663.44 lakhs.

Institutional strengthening

Institutional strengthening is essential to maintain the systems created and assets procured. Professionalism in solid waste management is, therefore, recommended by induction of professionals as under:

Designation	No. of Post Required	Existing Posts	Shortfalls/surplus
Executive Engineer	1	0	1
Assistant Engineers	4	0	4
Sanitary Officer/CSI	5	0	5
Sanitary Inspectors	14	12	2
Sub Inspectors	28	0	28
Supervisors	0	64	64 surplus
Total	**54**	**76**	**24 Surplus**

The existing sanitary supervisors could be trained to take up the position of sanitary Sub Inspectors and qualified Sub Inspectors could be recruited on contract for remaining positions. The revised requirement of sanitation workers and drivers has been worked out as under to make the entire operation cost effective.

Need of Sanitation Workers, Drivers, etc

Designation of Post	No. of Posts					
	Sanitation Workers			Drivers		
	Requirement	Existing	Shortfall/ Surplus	Requirement	Existing	Shortfall/ Surplus
Sanitation workers for primary collection of waste from households, shops and establishments	1060 (on contract not to count in staff)	0	- 1060 (to be taken part time on contract	0	0	0
Sanitation workers for sweeping of streets as per the yardstick	1650	1650	0	0	0	0
Drivers and labour for dumper placer machines	30	30	0	30	30	0
Sanitation workers/drivers for hoppers	20	20	0	20	20	0
Sanitation workers/drivers for skip lifter machines	3	3	0	3	3	0
Sanitation workers/drivers on 6 hotel waste collection vans @ 2/1 per van	To be done on contract					
Sanitation workers/drivers on 4 garden waste van, @ 2/1 per vehicle	To be done on contract					
Sanitation workers and drivers for large hauling vehicles at the transfer stations	19	19	0	19	3	-16
Sanitation workers at two transfer stations	8	8	0	0	0	0
Sub-total	1730	1730	0	72	56	-16
Weekly off relievers @ 17% for round the year service	288	288	0	12	0	-12
Total	**2018**	**2018**	**0**	**84**	**56**	**-28**

Legal Provisions

For improving solid waste management practices in city, the Supreme Court Committee has given wide ranging recommendations defining the roles and responsibilities of the citizens, NGOs, local bodies, etc. Subsequent to the aforesaid report, the Government of India, Ministry of Environment has notified municipal solid waste (Management & Handling) Rules 2000 under the Environment Protection Act 1986; these rules have clearly laid down the measures to be taken by the municipal corporations as well as smaller urban local bodies. Keeping in view both the above report and the rules it is necessary to incorporate suitable provisions in the state law to ensure public participation and for providing for minimum level of service.

Local law also needs to provide for punishment on the spot to those who do not adhere to the directions given for maintaining appropriate solid waste management system in the city giving adequate power to the corporation to punish the offenders. The legal provisions, which may be incorporated by the City/State Governments in the law-governing corporation, are explained in the relevant section.

Whosoever litters the street /or public places or deposits or throws or causes or permits to be deposited or thrown any solid waste or construction debris at any place in contravention of the provisions of this Act or permits the flow of any filthy matters from his premises shall be punished on the spot with a fine not less than Rs.50/- as may be prescribed under the rules framed by the State Govt. from time to time. Such spot fines may be collected by officers authorized by the Municipal Corporation, not below the rank of sanitary inspector. The amount of fine imposed shall be recoverable as arrears of property taxes. The amount of fine shall be kept higher for repeat offences.

Strategy for RRR and public/private sector participation

A detailed strategy has been given for promoting the concept of Reduce, Reuse & Recycle and to ensure community participation through effective information, education and communication methods.

For the successful implementation of any program involving public participation, it is essential to spell out ways in which public participation in hygienic Solid Waste Management (SWM) can be promoted and ensured, hand in hand with Municipal initiatives.

Citizen co-operation is vital for keeping garbage off the streets, especially at the very first stage of keeping biodegradable "wet" kitchen and food wastes unmixed and separate from recyclable "dry" wastes and other hazardous wastes. If the reasons for this are explained, public participation is bound to improve. A series of measures can be taken to bring about a change in public behavior through public awareness campaigns.

Strategy for NGO and private sector participation has also been given in the report to make entire system cost effective and efficient.

Budget for public awareness

Description of IEC activities	Amount in lakhs
Publicity through local cable network. 10 times a day on alternate day in the first year and twice a week in the subsequent year.	10
Advertisement in all local newspapers 4 times in the first three month to be repeated Twice in a quarter in next 6 months.	10
Distribution of 5 Lakhs pamphlets over a period of one years.	5
Banners. Put 4 banners of 12 ft. x 4 ft in each ward and about 100 banners at strategic market places. Total 400 banners.	2
Cinema slides. Make sets of 10 slides to be displayed for one year	1
Street plays. Organize one street play in every slum/colony through NGOs in one year.	20
Organize rally of students. 8 rallies in a year for two years.	4
Awareness training to municipal staff. Sweepers for 1/2 day, sanitary supervisors for 1 day.	1
Field visits/ exposure visits of the concerned officials of the corporation / other concerned institutions.	15
Miscellaneous expenses in organizing the events.	5
Awareness campaigns through group meetings over a period of one year	5
Special programmes during high pilgrim days	5
Continuous Awareness drive at Ghats/Colonies through NGOs	20.5
Total IEC Budget	**1.035 Crore**

Environment management plan

Environment management plan has been worked out to ensure improvement of health and environment in the city through modern systems of waste management and scientific treatment and disposal of waste at the engineered landfill.

Management information system

With the advancement of information technology, Geographic Information System (GIS) could be introduced in large cities and MIS may be integrated in this system. Similarly, there is a need for a citizen interface to seek comments, suggestions etc. on utility services.

Information that needs to be recorded and studied includes relevant information of the department for planning process as well as specific information to know whether every one involved in SWM services is performing his duty well, adequate vehicles are given to the SWM Dept. by the workshop, the vehicles give their optimum output, the repairing and maintenance of vehicles and equipment at the workshop is properly done, the vehicles carrying the waste to the disposal site are optimally utilized, the processing plants are performing well, landfill sites are well managed etc.

The first thing each morning the Municipal Commissioner should see is whether anything unusual or unsatisfactory has happened needing immediate remedial measures. A list of items is given below on which the data should be collected and kept on record for planning purposes and a few performas are designed for monitoring the activities done by various sections of SWM department as under which may be utilized by the local bodies with suitable modifications.

Chapter 1 INTRODUCTION

With the 74th amendment of the Constitution of India in 1992, municipal authorities in the country have been recognized as a third tier of government. The 12th schedule of the Constitution has laid down the functions envisaged to be performed by the municipal authorities; one among those functions is solid waste management. It is an obligatory duty of municipal authorities in the country to keep cities/towns clean and provide a good quality of life to the citizens. However, the services provided by the municipal authorities are outdated and very inefficient. Domestic, commercial, biomedical and variety of toxic and domestic hazardous wastes are generally disposed of by the citizens on the streets, drains, open spaces, water bodies, etc., causing serious problems of health and environment. Problems of solid waste management are growing with rapid urbanization and change in the lifestyle of the people. The situation is becoming critical with the passage of time. The urban population in India has gone up five times in the last six decades. As per 2001 census, 285.35million people live in urban areas in the country which accounts for 27.78% of India's population.

1.1 Magnitude of the Problem of Solid Waste Management

India has 4378 cities and towns which generate waste in the range of 0.2kg and 0.6kg per capita per day amounting to 1,15,000MT of waste per day i.e. 42million metric tons annually. As per the estimate of The Ministry of Urban Development, the 423 class-1 cities alone account for 72.5% of the total waste generated in the urban areas as shown in Table below.

Table 1: Waste generation in cities and towns

Types of cities	Tones/day	% of total garbage
The 7 mega cities	21100	18.35
The 28 metro cities	19643	17.08
The 388 class-1 towns	42635	37.07
Total	**83378**	**72.50**

The Energy Research Institute (TERI) has estimated that the waste generation will exceed 260 million tons by 2047 which speaks volumes of the problems that urban areas are going to face in coming decades in managing their waste.

1.2 Urbanization in the State of Uttar Pradesh

The State of Uttar Pradesh is the most populous state in the country. The state is having five cities above one million population. Their population and decadal growth could be seen from the following table.

Table 2: Population and decadal growth

Name of the city	2001 population	Decadal growth - 1991-2001
Kanpur	2555811	25.91%
Lucknow	2185927	30.96%
Agra	1275134	34.50%
Varanasi	1202443	17.09%
Allahabad	1081622	29.07%

Source: CDP Varanasi Aug.2006

All these cities, except Varanasi, are growing at a faster rate than the national average of urban growth of 28%. All the above cities are facing a challenge of providing essential infrastructure to keep pace with population growth. Solid waste management is one among the major challenges faced by these urban areas.

1.3 Launch of JnNURM

This is a major infrastructure development initiative undertaken by Government of India from December, 2005 to improve essential infrastructure in 35 one million plus cities, state capitals and certain important cities of India (63 cities). It is envisaged to invest Rs. 100000 crores over a period of 7 years.

The JnNURM consists of two sub missions:

(1) Urban infrastructure and governance and
(2) Basic service to the urban poor.

It believes that in order to make cities work efficiently and equitably, it is essential to create incentives and support urban reforms at state and city level, develop appropriate enabling and regulatory framework, enhance the creditworthiness of municipalities and integrate the poor with the service delivery system.

The JnNURM aims at i) encourage cities to initiate steps to bring about improvement in the existing service levels in a financially sustainable manner, and ii) encourage cities to initiate steps to bring about improvements of existing levels in a financially sustainable manner.

1.4 Objectives

The Primary Objective of the JnNURM is to create economically productive, efficient, equitable and responsive cities. In line with this objective, the mission focuses on:

- Integrated development of infrastructure services;
- Securing linkages between asset creation and maintenance for long run project sustainability
- Accelerating the flow of investment into urban infrastructure services.

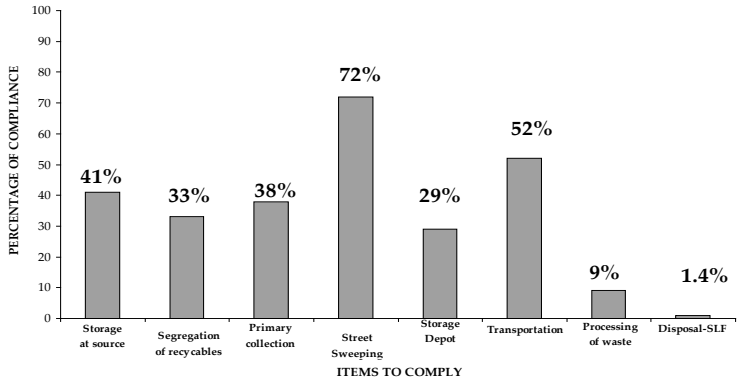
- Planned development of cities including the peri-urban areas, outgrowths and urban corridors
- Renewal and re-development of inner city areas
- Universalization of urban services so as to ensure their availability to the urban poor.

The mission on urban infrastructure and governance covers solid waste management as one of the important components.

1.5 Status of Solid Waste Management in Urban Areas

Looking to very pathetic situation of solid waste management in the country, the Ministry of Environment & Forest has notified Municipal Solid Waste (Management & Handling) Rules 2000 under the Environment Protection Act 1986. According to these rules, all the municipal authorities were expected to improve solid waste management practices in terms of aforesaid rules by December, 2003. But, the situation did not improve as expected for want of adequate technical know-how and lack of human and financial resources. A study of 128 class-1 cities undertaken to assess the situation revealed the position as under.

Compliance with MSW Rules 2000 as on 1st April, 2004



1.6 Financial Support to Improve SWM Services

To improve the situation, Government of India sanctioned 2500Crores exclusively for solid waste management from the 12th Finance Commission grants which supported state governments and municipal authorities to some extent to improve Solid Waste Management services. However, with the launching of JnNURM, the solid waste management has got a big boost in 63 cities covered under JnNURM as a provision of

100000 crores has been made to improve urban infrastructure in these cities.

1.7 Study of JnNURM Cities

To help JnNURM cities, the Central Pollution Control Board commissioned a study on the status of Solid Waste Management through National Environmental Engineering Institute, Nagpur. That report has observed that initiatives for collection of waste from house-to-house and its source segregation has been undertaken in only 7 cities, privatization of transportation of waste has been done in 11 cities and waste processing facilities have been set up in 15 cities. Out of these, ten waste processing facilities are based on composting and one of these composting facilities has provision for energy recovery technology. None of the city is having proper sanitary landfill site. Uncontrolled dumping of MSW has been observed in almost all the cities except one. Leachate collection is being practiced in only two cities and gas collection in only one city.

In many cities, bio-medical waste (BMW) is getting mixed with MSW and Slaughterhouse waste is not managed properly and is dumped at landfill site along with MSW.

Studies have revealed that waste generation rate varies between 0.12 and 0.60 kg per capita per day. Analysis of physical composition indicates that total compostable matter in the waste is in the range of 40 to 60 percent while recyclable fraction is observed between 10 and 25 percent. The moisture content in the MSW varies from 30 to 60 per cent while the C:N ratio in the range of 20-40.

Varanasi is one among the JnNURM cities and this study has revealed that Varanasi city generates 425 tonnes of waste per day. Out of which 45.18% waste is found compostable and 17.23% is recyclable. We have carried the studies for characterization and quantification of wastes in the city, which is being discussed in Chapter 3.

This detailed project report is prepared to avail of the Government of India and state government grants under JnNURM project to improve solid Waste Management services in the city.

Chapter 2 CITY PROFILE

Varanasi is a one million plus populated city situated in the State of Uttar Pradesh. It is the fourth largest city of the state and known for its mystic Ghats and rich architectural heritage. The city is situated between two rivers viz. "Varuna" and "Assi" and therefore known as Varanasi. The city is also called Banaras and Kashi. The city is believed to be more than 3000 years old and considered as the oldest living city in the world. Holy River Ganga passes through the east of the city. There are 85 ghats on the river Ganges, which are frequented by a large number of pilgrims everyday for taking a Holy dip in river Ganges. The city is well connected with air, road and railway links.

Pilgrims bathing at the Ghats on the bank of River Ganges

This historic city has a typical character where more than 100 narrow lanes having houses and commercial establishments on both sides leading to 85 ghats. These lanes are about 0.5 to 0.8 km long and connect with the main roads of the city. The other parts of the city have relatively wider roads and better infrastructure. The new development is taking place beyond Varuna River called Varuna Par as well as on the other side of River Assi. Varanasi has very famous temples besides holy river Ganges which attract a large number of devotees from within and outside the country.

Daily Aarti at the bank of River Ganges

The city is also known for its silk spinning and weaving industries as well as metal and metal manufacturing industry. Banarasi sarees are world famous. Besides, the city exports betel leave handicrafts, rugs and durries. The city also produces brass ware and copper ware as well as gold jewelry.

2.1 Area & Population

Varanasi city has an area of 79.79 Sq. Kms. Until 1991 the area of the city was only 56.65

Sq. Km. Varanasi has a population of 1202443 as per 2001 census. The city has grown six fold in last seven decades as could be seen from the table below.

Table 3: Population growth in the last seven decades

Year	Population	Decadal growth.
1931	207650	
1941	266002	28%
1051	355771	34%
1061	489864	38%
1971	671934	26%
1981	773865	25%
1991	1030863	33%
2001	1202443	17%

Source: Census of India, 2001 and CDP August, 2006.

The average floating population is estimated at 2 lakhs people everyday. The city of Varanasi can be broadly divided into two zones the Cis Varuna and Trans Varuna Zone. Most part of the city is presently living in Cis Varuna area but now with the provision of infrastructure facilities and the construction of Ring Road, the City is expected to grow towards Trans Varuna area.

The city has a minority population of 3.35 lakhs which primarily reside in Jaitpur, Adampur, Saraitha, Lallapur, Madanpur and Bajardiha.

2.2 Population Projections and basis of their adoption

The population projections for the City of Varanasi have been carried out by three methods and a comparison with the population projection in the CDP is shown in the table below:

Table 4: Population projections

Population Projection in the CDP			
Methods	**2011**	**2021**	**2031**
Geometric	1489931	1846154	2287544
Incremental increase method	1995366	3311161	5494624
Exponential	1576734	2067531	2711102
Average	**1687344**	**2408282**	**3497757**
Population Projection used in this DPR			
Methods	**2011**	**2021**	**2031**
Geometric	1524320	1932359	2449625
Incremental increase method	1426870	1706389	2041000
Arithmetic	1371777	1541112	1710446
Average	**1440989**	**1726620**	**2067024**

Table 5: Population projections as in the DPR on Water Supply for Varanasi City approved by Government of India.

S. No.	Methods	2010	2025	2040
1	Arithmetic	1330300	1543500	1756700
2	Geometric	1493100	2142100	3073000
3	Incremental increase method	1346500	1620500	19737000
4	Semilog Graphical Method	1600000	2280000	3300000
5	Area Density Method	**1666100**	**2473700**	**3317900**

From the above table it is clear that population projection by Arithmetical progression, Geometrical progression and incremental increase methods are on lower side.

The population projection by semilog graph methods and area density method are almost similar and seems to be more realistic according to the present population growth in the city. Therefore calculations done by area density methods have been adopted in the DPR prepared for Water Supply and approved by CPHEEO under JNNURM. Floating population of 50,000 is also considered and has been taken in DPR for Varanasi city.

Therefore, population projections based on this figure has been used for design of treatment and disposal facility in this DPR.

2.3 Population Density

The density of population is quite high as compared to many one million plus cities in the country. The population density of the city could be seen from the table below.

Table 6: Population densities

Year	Population	Area in sq. km	Density of population/ Sq.km
1991	1030863	56.65	18197
2001	1202443	79.79	15070

Source: Master plan of Varanasi 2011, CDP August 2006.

The ward-wise population density varies substantially. It ranges between 16 and 1991 per hectare. The details of ward-wise population density are given in Annexure-1. The city wards could be divided in three group viz. low density, medium density and high-density as shown in the table below:

Table 7: Ward wise density areas

Population Density	Ward Number	Remarks
>250	2,4,5,6,7,10,113,14,15,19,20, 21,23,25,27,28,31,32,33,38,51,60,61,64,65,71,72,73,75,77,79,82,84,85,86,88,90,91	Low density areas

251-600	1,8,9,12,17,22,30,34,37,39,41,45,4,47,48,49,53,55, 56,57,63,68,69,74,76,80,81,83,89	Medium density areas
<600	3,11,16,18,24,26,29,35,36,40,42,43,44,50,52,54,58, 59,62,66,67,70,78,87	High density areas

Average Household Size

As per 2001 census, average household size of Varanasi is 7.3 which is very high as compared to the national average of 5 persons per household and State average of 6.3 persons per household. The situation in the slum areas is still worse. The average household size in slums is of 10 members which is much higher than National and State averages.

2.4 Slums and Informal Settlements

Varanasi has 227 slums spread all over the city, either on government or private lands. Total population in slums is about 453,222, which is about 37.69% of the total population. Majority of slums have very poor water supply and sanitation facilities; solid wastes directly dumped into Open Nallas.

2.5 No. of Households, Shops Establishments & other Non-residential properties

The city has 177007 households, shops and establishments as 2001 census, details of which are as under.

Table 8: Details of establishments

Type of building	No.
Residential	117699
Residence cum other use	24399
Shops and offices	21491
Schools and colleges	735
Hotels, lodges, guesthouses	430
Hospitals and dispensaries	708
Factories, workshops, work sheds	1734
Place of worships	1745
Other non residential use	8066
	177007

Sources: Census of India, 2001 and CDP, August, 2006.

However, the municipal corporation estimates that now there are 1,70,000 households as against 142098 residential houses shown in 2001 census data shown in the table above.

2.6 Hotels, Lodges, etc.

The city has a large no. of hotels and restaurants as shown below.

Table 9: Hotels and restaurants in the city

Type of building	No.
Hotels	110
Lodges	95
Dharmashalas	47
Paying guesthouse	99
Restaurants	287

2.7 Vegetables and Fish Markets

There are 20 vegetable, 5 fruits, 5 meat and 5 fish markets in the city leaving behind a large quantity mixed waste rich in organic contents.

2.8 Climatic Conditions

The city experiences extreme climatic conditions. The average maximum temperature is 45.2^{o}C and minimum temperature is 1.8^{o}C. The average rainfall is only 737mm.

2.9 Political Set-up

The city has 90 election wards and an elected body comprising of 90 councilors. The Mayor heads the elected wing and chairs the general body meeting of the corporation. The city corporation has an executive committee to assist the council in managing the city affairs. The term of the elected council is for five years.

2.10 Administrative Set-up

The Municipal Corporation's administration is under the control of Municipal Commissioner. His appointment is made by the State Government from time to time. He is assisted by 2 Additional Commissioners, 2 Deputy Commissioners, City Engineer, City Health Officer, One Additional Health Officer and large number of officials and non official staff to carry out various functions of the corporation.

2.11 Decentralization of Administration

The city is decentralized into five administrative zones and 14 sanitary wards.

2.12 Solid Waste Management Department

This Department is headed by City health officer who is assisted by Additional Health Officer. He is responsible for all health programs such as malaria control, mother and child health care, family planning, birth and death registration, etc. besides Solid Waste Management. The City Health Officer is assisted by Additional City Health Officer, 12 Sanitary Inspectors and 64 Sanitary Supervisors for discharging his functions effectively.

2.13 Deployment of Sanitation Workers

There are 2876 sanctioned posts of sanitation workers out of which 1915 are permanent and 961 are contractual. Their deployment is sanitary workers is made as under.

Table 10: Deployment of Sanitary Workers

Nature of work	Number
Street sweeping	1650
Nalla and drain cleaning	406
Transportation of waste	806
Total	**2876**

The ward-wise details of deployment of sanitary workers as per the information furnished by ward level supervisors is kept at Annexure -2

Chapter 3 THE PRESENT SCENARIO OF SOLID WASTE MANAGEMENT AND STATUS OF COMPLIANCE OF MSW RULES, 2000 IN THE CITY

3.1 Quantity of Waste Generated

The Municipal Corporation of Varanasi has not weighed its waste so far. As per their eye estimate, waste generation rate estimated by the municipal corporation is 700 MT/day, out of which 600 MT waste is collected each day. The break up of estimated waste generated is as under.

Table 11: Category wise waste generation

Type of waste generators	Estimated quantity of waste generated MT
Households	500.00
Shops , workshops	100.00
offices, institutions etc.	45.00
Industries	15.00
Others	40.00
Total	**700.00**

Source: Varanasi Municipal Corporation

There is a big gap between the above estimates and the estimate given by CPCB in their recent study of JnNURM cities which puts a figure at 425MT /day only and CDP of the city which put the figure at 600MT/Day.

With a view to come to a correct figure of waste generated per day, an exercise was undertaken to weigh the waste transported to dump site. Weighing was carried out for seven consecutive days, which revealed that average waste generation rate is 480 MT/Day.

The quantities of waste measured at disposal sites more correctly reflect the quantities being disposed rather than those generated since the measurements do not include:

- Waste salvaged at the site of generation
- Waste disposed of in un-authorized places-empty lots, alleys, ditches etc.
- Waste salvaged by collectors

It was estimated that 25% of waste generated in the city is not collected for various reasons. This takes the waste generation rates to 600 MT/day which needs to be taken into consideration for planning the systems of solid waste management.

To further validate the estimates, we undertook a study to determine the quantity of waste generated in the city in three different economically and geographically different areas. This was done by collecting the waste from 200 households in each area and street sweepings collected at the secondary storage point from the restricted area conforming to same 200 households.

Average per capita waste generation in the city comes out to be **0.410 Kg per capita per day.**

As we know, the quantities of waste increase on two counts:-

a. Population growth
b. Per capita increase in waste generation due to change in life style and more and more use of packing materials

Taking into account the religious, industrial and commercial activities in the city of Varanasi and its future potential it is desirable to assume additional 1.5% increase in the quantity of waste generation each year. Therefore a realistic waste generation has been projected as shown in Table 13 below for the purpose of this DPR.

Table 12: Projected Waste Generation

Year	Population	Per capita waste generation	Waste Generation Based on Population MT/Day	After Adding 1.5% increase due to change in life style
2001	1202443	0.410	493.00	500.40
2010	**1716100**	**0.410**	**703.60**	**714.16**
2025	2523700	0.410	1034.72	1050.24
2040	3367900	0.410	1380.84	1401.55

The quantity of waste is estimated to be 714.16MT/day in 2010, as the design period for this DPR is 2011, we have taken total quantity of waste as 735 MT/Day for design purposes.

3.2 Physical Composition of Waste

The CDP has not carried out detailed analysis of waste but given the break up of waste as under:

Table 13: Physical composition of waste

Type of waste	Percentage
Road sweepings	75.00
Commercial waste	13.00
Construction waste	4.00
Nalla cleaning waste	2.00
Clinical waste	3.00
Industrial waste	3.00

In the CDP it is stated that most of the waste is biodegradable and recyclable.

We undertook a study to determine the composition of waste generated in the city in three

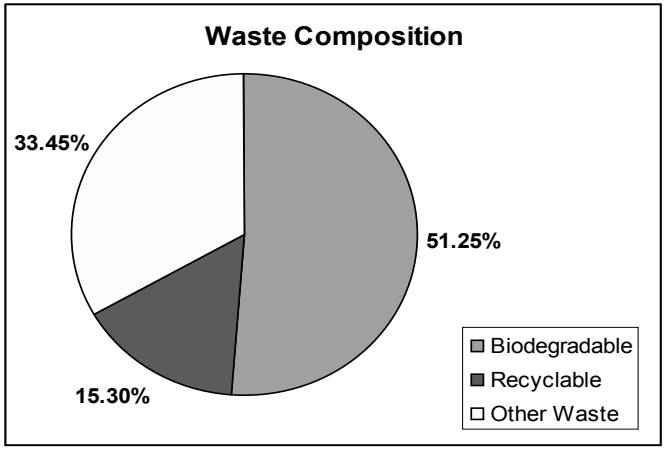
different economically and geographically different areas. This was done by collecting the waste from 200 households in each area and street sweepings collected at the secondary storage point from the restricted area conforming to same 200 households.

Table 14: Overall composition of waste generation in the city

Biodegradable		Recyclable		Other Waste	
51.25%		15.30%		33.45%	
Composition of recyclable waste					
Paper	Polythene	Plastics	Glass	Metals	Miscellaneous
32.8	25.6	7.3	5.7	5.8	22.8

An estimate has also been made in consultation with all the field officers about the quantity of flower waste generated from the temples and various ghats, and it is revealed that about **4.2 MT/Day** flower waste is generated each day.

Recyclable items include paper, plastics, polythene, glass, metal and other miscellaneous items.



Physical Composition of Waste

3.3 Status of compliance of MSWM Rules 2000

The MSW Rules 2000 mandate the following seven essential steps.

1. **Prohibit littering on the streets, promote segregation of recyclable waste at source and ensure storage of waste at source in two bins; one for biodegradable waste and another for recyclable material.**
2. **Organize Primary collection of biodegradable and non-biodegradable waste from the doorstep, (including slums and squatter areas,) at pre-informed timings on a day-to-day basis using containerised tricycle/handcarts/pick up vans.**
3. **Organize Street sweeping covering all the residential and commercial areas on all the days of the year irrespective of Sundays and public holidays.**
4. **Abolish open waste storage depots and make provision of covered containers or closed body waste storage depots.**
5. **Organize Transportation of waste in covered vehicles on a day to day basis avoiding multiple and manual handling of waste.**
6. **Set up treatment facilities for biodegradable waste using composting or waste to energy technologies meeting the standards laid down in schedule IV.**
7. **Minimise the waste going to the land fill and dispose of only rejects from the treatment plants and inert material at the engineered landfills meeting the standards laid down in Schedule III of the MSWM Rules 2000.**

These steps were to be implemented before 31st December, 2003. However, for various reasons, municipal corporations have not been able to implement these steps fully in spite of efforts made to meet the requirements of law. The present status of compliance of the MSWM Rules 2000 is as under.

STEP 1 Prohibit littering of waste on the streets and storage of waste at source.

The Municipal Corporation has not yet prohibited littering of waste on the streets. However 30% of the population at its own stores the waste at source and deposits the waste in the municipal bin. Rest of the house holds, shops and establishments do not store the waste at source and continue to throw the waste on the streets and, therefore, the streets continue to remain dirty and littered. The ward inspectors have estimated the situation of storage of waste at source. Indiscriminate disposal of waste on the streets causes nuisance to the people, clog the surface drains, contaminates water bodies, etc., as could be seen from the photographs below.

Waste seen disposed of on the streets

3.4 Segregation of Recyclable Wastes

No special efforts are made by the municipal corporation to educate the citizens to segregate recyclable waste. Traditionally, segregation of recyclable waste is partially practiced by households/commercial establishments for sale to kabadiwalas (waste purchasers) as could be seen from the photographs below. Rest of the recyclable material is disposed of by the residents along with domestic waste in a mixed form. This waste finds its way on the streets, in the drains, dumping grounds, etc., from where rag pickers collect the waste to earn their livelihood. Recyclable waste is generally found mixed with domestic waste. The compliance in regard to segregation of recyclable waste is reported to NIL.

Rag-pickers sorting sellable material from the dumpsites

Recyclable waste packaged to be sold

STEP 2 Primary Collection

3.5 Primary Collection of Domestic, Trade and Institutional Waste

There are approximately 170000 households, 59308 commercial establishments, offices and institutional buildings in the city which include 24399 mixed use buildings. System of primary collection of waste from the doorstep has not been introduced in any part of the city. In absence of the facility of doorstep collection, the entire city continues to throw the waste on the streets, open space, drains, water body etc. Only some people do deposit the waste at the waste storage depot.

Waste lying in the street

3.6 Special Problems of Varanasi

3.6.1 Disposal of flowers in the river.

Varanasi has as many as 85ghats which are frequented by a large number of pilgrims and tourists. Several types of religious ceremonies are performed at these ghats and these ceremonies generate variety of wastes which are traditionally immersed in the holy river flowing next to ghats. Flowers form a major component of such waste. They keep floating and pollute the river. The Municipal Corporation makes special efforts to remove these flowers through boats as could be seen from the photographs below.

Disposal of flowers in River

3.6.2 Disposal of ashes arising out of cremation at the ghats

There are two major cremation ghats namely HARISHCHANDRA GHAT and MANIKARNIKA GHAT where on an average 125 bodies are cremated each day using traditional firewood. Ash generated in this process find its way in the holy river Ganges as could be seen from the photograph below.

Disposal of ashes out of cremation at the ghats

3.6.3 Open defecation/urination at the ghats

Several people live very close to the ghats. They are poor and have no toilet facilities. They defecate on the ghats and create serious problems of health and sanitation

Open defecation/Urination at the Ghats by slum dwellers

3.6.4 Washing of clothes and bathing of cattle in the ghats.

Washer men and cattle breeders also carry on there activities on the ghats and in the river creating unsanitary conditions and pollution as could be seen from the photographs below.

Washing clothes and bathing Cattle at Ghats

STEP 3 Street Sweeping

3.7 Street Sweeping

The road conditions and overall city cleaning is fairly good. The corporation has a road length of 1247.00 km, the details of which are given in table below.

Table 15: Road length

Length of concrete / asphalt roads in km	Length of non-asphalted roads km	Length of roads having dividers. km
868	379	16

3.8 The Density of Roads

The density of roads is shown in the table below. Certain areas are very dense whereas some portions of the city are having very low density.

Table 16: Density of roads

Density	Road length
High density	440 KM
Medium density	428 KM
Low density	379 KM

3.9 Frequency of Cleaning the Streets

The municipal corporation has undertaken cleaning of most of the streets on a day to day basis. 70% of the streets are cleaned daily. The frequency of cleaning of all the streets is shown in the table below.

Table 17: Street sweeping

Frequency of Street Cleaning (in percentage)				
Daily	Alternate Days	Twice in a week	Once in a Week	Occasionally
70%	15%	10%	2%	3.0

The compliance level of this step is 70%. The ward-wise compliance details are given in Annexure - 4

3.10 Work Norms

No work norms have been prescribed for sanitation workers. The working hours are seven. They are expected to walk about 500metres for depositing their waste at waste storage depot. No work is done on Sundays.

3.11 Tools Used in Street Sweeping

3.11.1 Use of long handled brooms

Majority of the sweepers are given long handled brooms which are quite efficient as could be seen from the photograph below:

3.11.2 Use of handcarts/tricycles

977 traditional Handcarts and 50 tricycles without bins are used for primary collection of waste from the streets in an inefficient manner.

3.11.3 Process followed

Step 1. The street sweepers make small heaps
Step 2. Cart man picks up the waste from the streets and from the households.
Step 3. The waste so collected is taken to waste storage depot

Entire process is depicted in sequential photographs.

Traditional Street Sweeping process

STEP 4 Secondary Storage

3.12 Waste Storage Depots

Waste storage depots are an eyesore in the city.

There are varieties of waste storage depots established in the city, the details of which are given in the Table below:

Table 18: Details of waste storage depots

Type of waste storage depots	No.
Open waste storage sites	27
Masonry bins	20
Cement concrete bins	0
Metal containers	65
Total	**112**

Ward wise details of existing waste storage depots are given in Annexure-5

It can be observed from the above table that there are very few waste storage depots in the city and majority of waste is deposited at open or large masonry storage depots where

Existing Waste Storage Depots

waste is deposited by the sanitation workers on the ground causing unhygienic conditions as seen from the photographs below.

Lack of synchronization between primary collection and secondary storage

There are only few sites where containers have been placed; but no synchronization is made between primary collection and secondary storage.

Traditional carts/tricycles compel the workforce to deposit the waste on the ground instead of directly transferring the waste into the container. This results in unhygienic condition around the container and necessitates multiple handling of waste as could be seen from the photographs below. The compliance of MSW Rules in regard to this component is about 10%.

Lack of Synchronization between primary collection and secondary storage

STEP 5 Transportation

3.13 Transportation of Waste

Transportation work is not scientifically designed. Municipal Corporation has introduced a few containers and dumper machines but has not synchronized the primary collection with secondary storage with the result the waste is initially deposited on the ground and later manually loaded in the containers causing unsanitary conditions .Besides, all open waste storage sites and masonry sites are attended by loader machine or manually in a very unhygienic manner as could be seen from the photographs below.

The transportation work is not carried out on all the days of the year. No work is done on Sundays and public holidays,

Transportation of waste in open uncovered truck

which give rise to accumulation of waste and consequent backlog.

3.14 Availability of Vehicles for Transportation of Waste

The number and types of vehicles available with the municipal corporation is given in table below. 27 vehicles are more than 10 years old.

Table 19: Details of vehicles available with the corporation

Type of vehicles	No. of vehicles	Volume of each vehicle in Cu. m	Age of the vehicle
Tipper/dumper trucks	19	9.0	2 dumper/tipper-20 years 3 dumper/tipper - 17 years 3 dumper/tipper - 14 years 4 dumper/tipper - 11 years 4 dumper/tipper - 07 years 3 dumper/tipper - 02 years
Dumper placer	12	3.0	3 dumper placer - 09 years 6 dumper placer - 08 years 3 dumper placer - 07 years
Tractors	17	3.0	2 tractors - 25 years 2 tractors-21 years 2 tractors - 14 years 4 tractors - 11 years 5 tractors - 10 years 2 tractors - 03 months
Hoppers	22	1.0	5 hoppers - 05 years 8 hoppers - 04 years 4 hoppers - 02 years 5 hoppers - 03 months

The corporation has been using many open vehicles for transportation of waste and therefore, the compliance of MSW Rules in the matter of transportation of waste on a day to day basis in a covered vehicle is only 10% though the transportation efficiency is 85%.

The vehicles are used in two shifts and on an average tractor make two trips, whereas dumpers, hoppers and dumper placers make four trips in one shift. 16 regular and 40 contractual drivers are deployed by the corporation for their transportation of waste.

3.15 Maintenance Workshop

A municipal workshop is located near the Raja bazaar road and Patel road in the central district of the city. The repair equipment includes grinder, hand grill, air compressor, etc. most of the vehicles are old and need replacement/maintenance.

Vehicle Maintenance Workshop

STEP 6 Waste Processing

The City Corporation does not have any facility for processing of municipal solid waste. The entire waste of the city is disposed of at the dumping grounds untreated.

The present compliance of MSW Rules in regard to treatment of municipal solid waste is thus NIL.

No Treatment of waste

STEP 7 Waste Disposal

3.16 Disposal of Waste

City Corporation is unfortunately having no landfill site for treatment and disposal of waste. About 400MT of mixed waste brought from the city is haphazardly disposed of in the Varuna tributary of river Ganges and another 200MT of waste is disposed of in a private nursery land. Prior to this waste has been deposited in river Assi as well as several low lying areas and is lying there uncovered. The waste is neither spread, compacted or covered. Waste is seen lying there in heaps of 1 to 10metre height. At the present juncture, in absence of construction of an engineered landfill cell, the disposal of waste as per the MSW Rules is not being carried out and the percentage of compliance of the

landfill component is zero.

The following photographs show the pathetic situation of waste disposal in the river and other places.

Existing waste dumps

3.17 Overall compliance of MSWM Rules 2000

Ward-wise information is collected from all the 90 wards of the city to ascertain the level of compliance in respect of all the 7 steps of MSW Rules 2000. The consolidated picture of the same has emerged as under.

Table 20: Overall compliance with the MSWM Rules 2000

Name of the zone	Name of the ward	Storage of Waste at Source	Segregation of Wastes	Door to Door Collection	Street Sweeping	Secondary Storage	Transportation	Treatment	Disposal
Dashaswamegh	Dashaswamegh	10	0	10	100	5	5	0	0
	Chetgunj	0	0	0	95	0	0	0	0
	Sigra	0	0	0	90	25	25	0	0
Kotwali	Chowk	0	0	0	100	0	0	0	0
	Kotwali	0	0	0	95	5	5	0	0
Bhelupur	Bhelupur	0	0	0	98	5	5	0	0
	Khojwa	0	0	0	70	10	10	0	0
	Nagwa	0	0	0	70	10	10	0	0
Varunapar	Sikrol	10	0	0	70	25	25	0	0
	Shivpur	0	0	0	70	15	15	0	0
	Nadeshar	0	0	0	70	15	15	0	0
	Sarnath	0	0	0	80	20	20	0	0
Adampur	Adampur	5	0	0	75	0	0	0	0
	Jaitpura	0	0	0	95	0	0	0	0
	Total	**25**	**0**	**10**	**1178**	**135**	**135**	**0**	**0**
	Average	**1.79**	**0.00**	**0.71**	**84.14**	**9.64**	**9.64**	**0.00**	**0.00**

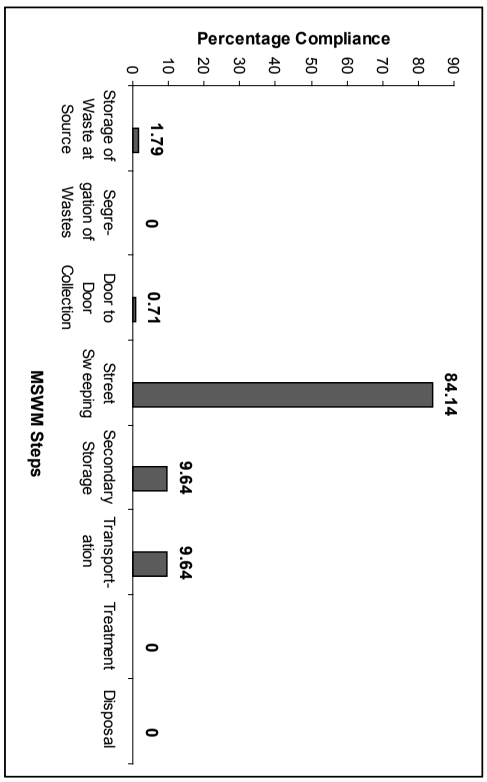


Chart 2 Overall Compliance to the MSWM Rules 2000

It is seen from the table above, that a lot is required to be done and a strategy has to be evolved to ensure that the deficiencies are met and compliance of all the 7 steps is made expeditiously.

Chapter 4 APPROACH & METHODOLOGY

4.1 Consultations with Stakeholders

In the direction of modernizing the solid waste management systems in the city in terms of MSWM Rules 2000, the first essential step taken was to have detailed consultation with the stakeholders. The consultants began with Municipal Commissioner. It was very heartening to see that the Municipal Commissioner was very keen to improve the Solid Waste Management Systems in the City by introducing appropriate systems and technologies which may be sustainable for the city and yet cost effective. He was also keen to involve all the stakeholders so that they can share there views, experiences and reservations and be a party in decision making.

Field Visits and Consultations

In keeping with the dynamic approach of the commissioner, detained consultations were held with all stakeholders, which included all the Supervisory Staff dealing with Solid Waste Management, Health Officers, Deputy and Additional Commissioners and various Departmental Heads.

Detailed interactions were also held with Honourable Mayor and members of the Executive Council of the Corporation. Discussions with these stakeholders were carried out to understand their perceptions of solid waste management and learn their views on the systems of waste management which can be introduced in the city to tide over the difficulties encountered by them in managing municipal solid waste in the city. All aspects of solid waste management were discussed in details and their observations noted.

4.2 Field Visits

The second essential step that was considered necessary was to carry out extensive site visits to get a complete idea of situation prevailing on the field and identify the system deficiencies vis-à-vis MSWM Rules 2000. The entire system of waste management was accordingly studied along with Municipal Commissioner and other senior officials on the field, deficiencies were noted and documented.

Consultations were also held on site with the field staff and their difficulties in the operation of SWM systems was studied and they were motivated by the commissioner to put their heart in work and own the project to improve the quality of life in the city. The response was very encouraging. The following photographs show the field consultation by the municipal commissioner and the consultants.

Based on the stakeholder consultation and the observations on the field, the following recommendations are now made to improve the entire system of waste management in the city.

Chapter 5 PROPOSAL FOR IMPROVING SOLID WASTE MANAGEMENT SYSTEMS

Government of India, Ministry of Environment and Forest have notified Municipal Solid Waste (Management & Handling) Rules 2000 in September, 2000 and made it mandatory for all the municipal authorities in the country to implement the following seven steps latest by 31st December, 2003. Municipal Corporation was accordingly expected to improve the systems of solid waste management and set up treatment and disposal facilities by the end of December, 2003 but for various reasons it has not been able to do so effectively till date. It is now recommended to take the following actions expeditiously:

5.1 Prohibit Littering; Ensure Source Segregation of Recyclables and Storage of Waste at Source

MSW Rules 2000 have laid down the following compliance criteria in this regard.

"Littering of municipal solid waste shall be prohibited in cities, towns and in urban areas notified by the state government".

"In order to encourage the citizens, municipal authority shall organize awareness programs for segregation of waste and shall promote recycling or reuse of segregated material. The municipal authority shall undertake phased program to ensure community participation in waste segregation. For this purpose, regular meetings at quarterly intervals shall be arranged by the municipal authorities with representatives of local resident welfare association and non-government organizations".

Segregation at source has been given top most priority and efforts have been made to ensure that recyclable material is collected at the door step and passed to the recycling industry through formal or informal sector without burdening the municipal system of secondary storage and transportation of waste. Keeping this arrangement in mind no provision for secondary storage of recyclable waste has been made. The recyclables will be collected from the door step in containerized tricycles / handcarts and will be taken away by waste collector without putting it into the secondary storage system.

This is the first essential step of solid waste management where citizens have to play a participatory role as without community participation SWM systems can never succeed. The corporation may, therefore take following three actions to ensure compliance of this direction.

1. Issue directions to citizens
2. Create awareness to comply
3. Take enforcement measures to ensure compliance

5.1.1 Measures for households

Corporation may Issue direction to citizens prohibiting littering of waste on the streets, open spaces, water bodies, drains, etc., and direct them to store the waste generated at source in two bins, one meant for biodegradable/food waste and another for recyclable material such as paper, plastic, metal, glass, rags. The illustrative list of biodegradable and recyclable material is kept at Annexure 6

The municipal corporation may also take up a massive awareness campaign to educate the citizens not to litter and practice source segregation of recyclable waste and biodegradable waste. They should use two domestic bins for this purpose

5.1.2 Measures for handling the waste generating from religious ceremonies

The City of Varanasi being a holy city frequented by a large number of pilgrims for taking a dip in holy River Ganges, offering prayers in the temples and mosques, visiting ancient Ghats, performing cremation of their dear ones at the Ghats, a lot of waste is generated in the form of flowers, puja material, ashes, etc. All this waste has to be prevented from getting into the river by educating the citizens on the pollution it causes in the holy river they worship and convince them of using some better ways to dispose of the flowers, puja material, etc., which may not hurt their religious sentiment and yet stop pollution in the river.

5.1.3 Provision of special container for storing flowers/puja material, etc

The municipal corporation may provide special decorative containers as shown in the photograph below titled "Pushpa Patra" at various Ghats where people generally dispose of flowers and other puja material. Similar containers may be placed in major temples where enormous quantities of flower waste are generated. The list of temples showing the quantity of flower waste generated is kept at Annexure - 8 to facilitate placement of special containers at the cost of the corporation or even at the cost of temple authorities.

Pushpa Patra

These flowers could be converted into very useful compost around the Ghats or around the temples by using a special composting machine available for such purpose as shown below, detailed specifications of which are given in Annexure - 9

Organic Waste Container

5.1.4 Handling domestic hazardous waste

The citizens may also be advised not to deposit domestic hazardous waste such as used batteries, discarded medicines, paints, pesticides, etc., in the bins meant for biodegradable and recyclable material and instead keep the same separately as and when generated and deposit the same at the domestic hazardous waste collection center that may be established in the city by the corporation. The illustrative list of domestic hazardous waste is given in Annexure -7.

5.1.5 Type of domestic bins to be used

Use of plastic or metal containers with lid as shown in the photograph below is advised for the storage of food/biodegradable/wet waste and a similar size bin or bag with or without lid may be used for storage of recyclable material. Two containers of 15-litre capacity for a family of 5 members would ordinarily be adequate. However, a household may keep larger containers or more than one container to store the waste produced in 24 hours having a spare capacity of 100% to meet unforeseen delay in clearance or unforeseen extra loads.

Storage of domestic waste in two bins

5.1.6 Provision of community bins

A private society, association of flats/multistoried buildings etc. may be directed to provide a set of covered community bins of 100litre capacity for 20 to 25 houses and advise the members of their society/association for storage of biodegradable and non-biodegradable domestic waste in these community bins separately to facilitate collection of such waste by the city corporation from the designated spot.

5.1.7 Shops/ Offices/ Institutions/ Workshops etc.:

There are 59308 shops, workshops, offices and industries in the City. All these establishments may be directed that:

1. They should refrain from throwing their solid waste /sweeping etc. on the footpaths, streets and open spaces.
2. They should keep their waste on-site as and when generated in a suitable container until the time of doorstep collection.
3. The size of the container should be adequate to hold the waste they normally generate in 24 hours with 100% spare capacity to meet unforeseen delay in clearance or unanticipated extra loads.
4. They should keep domestic hazardous waste listed in Annexure-7 separately as and when produced and dispose of as per directions given by the corporation.
5. The association of large commercial complexes should provide one or more containers of the size that may be prescribed by the corporation which match with the waste collection and transportation system of the Corporation for the storage of waste by their members. The association should direct their

members to transfer their waste into the community bin before the prescribed time on a day-to-day basis.

6. The association should consult the City Corporation in this matter and finalize the type of bin to be used and the location where such community bin/s should be placed to facilitate easy collection of such waste.

5.1.8 Hotels and Restaurants:

There are 351 hotels, lodges, Dharmasalas and guesthouses and 287 restaurants in the city generating about 30MT of waste each day.

All these hotels and restaurants may be directed that:

1. They should refrain from throwing their dry and wet solid waste/sweepings on the footpath, streets, open spaces or drains.
2. They should also refrain from disposal of their waste into municipal street bins or containers.
3. They should store their waste on-site in sturdy containers of not more than 100 Litre capacity each. The containers should have appropriate handle or handles on the top or side and rim at the bottom for ease of emptying.
4. They shall keep hazardous waste listed in Annexure - 7 separately as and when produced and dispose it of as per the directions.

In case of large hotels and restaurants where it may not be convenient to store waste in 100 litre or smaller size containers, they may keep large containers of which match with the primary collection and transportation system of the corporation that is proposed to be introduced in the city.

5.1.9 Vegetable Markets

a) There are 20 vegetable and 5 fruit markets in the city. The vendors throw the waste on the floor of the market and create unhygienic condition.

b) The City Corporation may provide large size containers of 7.00 cubic meter with lid as illustrated below for the storage of market waste at suitable locations within the market on full cost/partial cost recovery as deemed appropriate.

Large containers placed in Vegetable / Fruit market on a paved floor for the storage of market waste.

The shopkeepers may be directed that they shall not dispose of waste in front of their shop/Establishment or anywhere on the street or in open spaces and instead shall deposit their waste as and when generated into the large size container that may be provided for the storage of waste in the market.

5.1.10 Meat and Fish Markets

There are 5 meat and 5 fish markets in the city. The meat/fish market owners may be directed that

a) They should not throw any waste in front of their shops or anywhere on the streets or open spaces.

b) They should keep within their premises sturdy containers (of size not exceeding 100 litres) having lid, handle on the top or on the side and rim at the bottom of the container with adequate spare capacity to handle unforeseen loads.

5.1.11 Street Food Vendors

Street food vendors generate lot of waste at road side eating joints. A drive may be undertaken to educate street vendors and they may be directed not to throw any waste on the street or pavement. They must keep bins or bags for the storage of waste that generate during their activity. Their handcarts must have a shelf or canvas below for storage of waste generated in the course of business.

5.1.12 Marriage halls /Community halls, etc

Lot of waste is generated when marriage or social functions are performed at these places and unhygienic conditions are created which may match with the secondary

storage or transportation system of the City Corporation should be provided by these establishments at their cost and the site of their placement should be finalized in consultation with the City Corporation to facilitate easy collection of waste.

5.1.13 Hospitals/ Nursing Homes / Maternity Centre / Pathological Laboratories/Health Care Centres/Establishments etc.

The city has 2 general hospitals 106 nursing homes and approximately 100 path-labs in the city. These establishments produce bio-medical as well as ordinary waste.

These establishments may be directed that they should not throw any bio-medical waste on the streets or open spaces, as well as into the municipal dustbins or the domestic waste collection sites.

They should also refrain from throwing any ordinary solid waste on footpaths, streets or open spaces/nallas.

They should keep colour coded bins or bags as per the directions of the Govt. of India, Ministry of Environment dated 20th Bio-medical Waste (Management & Handling) Rules 1998, and follow the directions of CPCB & State PCBs from time to time for the storage of biomedical waste including amputated limbs, tissues, soiled bandages, used injections, syringes, etc. Another container with a lid for storage of food waste and other waste fit to be disposed of into the municipal domestic waste stream shall also be provided by them.

The storage of bio medical waste shall be done strictly in conformity with directions contained in the Govt. of India's aforesaid notification.

5.1.14 Construction and Demolition waste

To keep the city free from haphazard disposal of debris, directions may be given that:

1. No person shall dispose of construction waste or debris on the streets, public space, footpath or pavement or in the nallas.
2. Construction waste shall be stored until removed only within the premises of the building, or in containers from the day the facility of renting out containers is made available. In exceptional cases where storage of construction waste within the premises is not possible, the waste producer should take prior permission of the City Corporation for temporary storage of such waste outside their premises and having obtained such permission, may store such waste in such a way that it does not hamper the traffic, the waste does not get spread on the road and does not block the surface drain or storm water drain.
3. City Corporation may create a facility of renting out skip containers through private sector for the storage of construction waste as illustrated below. The

corporation may, to begin with to make a provision of 30 containers and 3 skip lifters to introduce this facility in the city.

Skip (container) meant for the storage of construction/demolition waste.

5.1.15 Garden waste:

Citizens having lawn plots may be directed not to throw the yard waste outside their premises. They should enter into a contractual arrangement with the corporation to collect the yard waste. They should store the yard waste in large jute bags and transfer the same into a municipal system on a weekly basis on payment. The generation of such waste should as far as practicable be regulated in such a way that it is generated only a day prior to the date of collection of such waste and should be stored in the premises and kept ready for handing over to the municipal authorities or the agency that may be assigned the work of collection of such waste by the city corporation.

For removal of garden waste, zone-wise arrangements may be made and one vehicle may be allotted to each zone to cover the premises producing garden/yard waste on a weekly basis. The City Corporation may contract out this service on full cost recovery basis or provide the service departmentally on full cost recovery basis. The names of the households and commercial establishments having private gardens may be listed in each ward and brought under the contractual arrangement.

5.1.16 Solutions to the Special Problems faced by Varanasi

Collection of flowers

The flowers are being disposed in the river from time immemorial. This habit is difficult to change unless a serious effort is made to educate the citizens that the flowers pollute the river and they need to adopt some better ways of disposal. Composting of flowers to make fertilizer is one solution to the problem which can be tried out. Containers for flowers called “Pushpa patra” must be placed at important ghats and major temples where flower waste is generated and all “pujaris” may be educated to advice the citizens to put the flower waste in these containers only. The flowers collected may be compacted using flower compacting machines suggested in the report. Till such time the system picks up removal of flowers floating in the river through boats may continue.

Disposal of Ashes

It is an age old tradition amongst Hindus that ashes after cremation are immersed in the holy river. People bring dead bodies for cremation at the ghats from long distances. There are two main cremation Ghats namely Harishchandra Ghat and Manikarnika Ghat. Nearly 125 dead bodies are brought here everyday for cremation and the ashes are immersed into the holy river leading to pollution.

The corporation may place metal containers at these ghats to store the ashes and transfer containers from time to time outside the ghats and transfer the same to a special cell for such ashes to be created at the disposal site to honour the sentiments of the people. A small cell named suitably can be created, enclosed and covered by trees where the ashes may be buried.

Preventing open defecation / urination at ghats

Adequate pay and use toilet facilities may be created near the ghats with a facility of family pass at low fee for those who live near the ghats to make it possible for them to use the facility easily. Watch may be kept for sometime to prevent open defecation.

Preventing washing of clothes and bathing cattle in the ghats

Washing of clothes in the river may be diverted to an enclosed place near the treatment plant which may be specially created in such a way that the waste doesn’t enter the river but goes directly to the treatment plant along with sewage and is treated. Once such a facility is created washer men can be directed to move over to the washing area.

Entry of animals at the ghats can be prevented by placing cattle trappers at the entry

of the ghats and cattle breeders may be educated and directed not to bring the cattle to the ghats for bathing.

5.2 Segregation of Recyclable/Non-Biodegradable Waste

It is essential to save the recyclable waste material from going to the waste processing and disposal sites causing hindrance in waste processing as well as using up landfill space. Profitable use of such material could be made by salvaging it at source for recycling. This will save national resources and also save the cost and efforts to dispose of such wastes.

The corporation may, therefore, draw up a quarterly program of conducting awareness campaign in various wards of the city utilizing the ward committees, local NGOS and resident welfare association. Simple literature may be developed for bringing in the awareness which may be publicized through media using cable net work and group meetings in different areas through NGOs. The sanitation supervisors may also create awareness during their field visits.

The following further measures may be taken by the corporation towards segregation of recyclable waste:

The City Corporation may mobilize NGOs to take up the work of organizing rag-pickers and upgrade them to door step "waste collectors". This can be done by offering them part time work of 4 hours for door to door collection of both biodegradable waste as well as recyclable waste. They may be allowed to recover a small charge of Rs. 10-20/month from every house and take away the recyclable material which they collect each day to earn extra amount for their living. As an option, the collection cost could be recovered from the beneficiaries in the form of user fees or sanitation tax by the corporation or paid by the municipal corporation from its budget to the NGO as deemed appropriate by the corporation.

The city corporations may actively associate resident associations, trade & Industry associations, CBOs and NGOs in creating awareness among the people to segregate recyclable material at source and hand it over separately to the waste collector. The City Corporation may give priority to the source segregation of recyclable wastes by shops and establishments and later concentrate on segregation at the household level.

The upgraded rag pickers on becoming doorstep waste-collectors may be given an identity card by the NGOs organizing them so that they may have acceptability in society. The City Corporation may notify such an arrangement made by the NGOs and advise the people to cooperate.

5.3 Primary Collection of Waste from the Doorstep

This is a very important function that the municipal corporation must perform effectively to improve the system of solid waste management in the city. The MSW rules 2000 give the following direction for the primary collection of waste.

a. Organize house-to-house collection of municipal solid wastes through any of the methods, like community bin collection (central bin), house to house collection, collection on regular pre-informed timings and scheduling by using bell ringing of musical vehicles (without exceeding permissible noise levels).

b. Devising collection of waste from slums and squatter areas or locality including hotels, restaurants, office complexes and commercial areas.

c. Wastes from slaughter houses, meat and fish markets, fruit and vegetable markets, which are biodegradable in nature, shall be managed to make use of such waste.

d. Biomedical waste and industrial waste shall not be mixed with municipal solid waste and such wastes shall follow the rules separately specified for the purpose.

e. Collected waste from residential and other areas shall be transferred to community bin by hand-driven containerized cart or other small vehicles.

f. Horticulture and construction or demolition waste or debris shall be separately collected and disposed of following proper norms. Similarly, waste generated at dairies shall be regulated in accordance with state laws.

g. Waste (garbage, dry leaves) shall not be burnt.

h. Stray animals shall not be allowed around waste storage facility or at any other place in the city or town and shall be managed in accordance with the state laws.

i. The municipal authority shall notify waste collection schedule and the likely method to be adopted for public benefit in a city or town.

j. It shall be the responsibility of generator of waste to avoid littering and ensure delivery of waste in accordance with the collection and segregation system to be notified by the municipal authority as per para (i) above.

To meet the above mandatory directions, it is necessary for the municipal corporation to provide a daily service to all households, shops and establishments for the collection of putrescible organic/food bio-degradable waste as well as recyclable/non-biodegradable waste from the doorstep. This service must be regular and reliable. Domestic hazardous waste is produced occasionally so such waste need not be collected from the doorstep. People could be advised or directed to deposit such waste at special domestic hazardous waste collection center that may be set up in

the city by the corporation and be given wider publicity.

The following arrangements may be made by the city corporation for primary collection of waste.

5.3.1 Door to door collection from households

The municipal corporation may divide each ward into units of 200 to 250 houses each and similarly divide the commercial streets into units of 150 to 250 shops and establishments (depending on the size of establishments). One part time worker per unit may be assigned the work of door to door collection of waste every day in the morning between 7 and 11 am or any other time that may be convenient to the corporation/citizen. This part time worker may be appointed by the corporation through RWAs, NGOs or private sector preferably by upgrading the rag pickers or engaging the existing private sweepers working in several colonies and housing areas. The norm of 200-250 households is suggested with a view to optimally utilize the 4 hours time of a part time worker and enable him to earn adequate amount per month for a better living. Experience of Model SWM projects supported by GoI at North Dum Dum and New Barrakpore Municipalities have shown that even 300 houses can be covered in 4 hours in low density areas.

Keeping in view the experience of Ahmedabad and various other cities a norm of 200-250 households is suggested. An average of 200 household is better so that in low density areas a worker could be given 150 houses and in high density areas he would be given 250 households, making it an average of 200 households per part time worker per day. This will become cost effective for the municipality besides providing better wage to the part time worker. The city has a few good NGOs. Their services can be utilized. Optionally private sector may be involved to provide these services on a contractual arrangement.

5.3.2 Door step collection through containerized handcart/tricycle with a bell

Each waste collector in the congested area may be given a containerized handcart of 30/40litre capacity and containerized tricycle having detachable containers (preferably 6 in number) of 60litre capacity in other areas. A bell may be affixed to the handcart/tricycle or whistle may be given to each waste collector. Each waste collector may be given a fixed area and a fixed number of houses/shops for the collection of waste.

Use of containerized handcart/tricycles for door to door collection of waste

The city has a present population of approximately 14 lakhs which is expected to increase to 14.93 lakhs by 2011 and 25.74 lakhs by 2031. There Are 184833 census houses comprising of households, shops, offices, etc., as per 2001 census. All these households and establishments plus the new houses that have come up in last six years need to be served on a daily basis. Considering about 15% decadal growth, the number of houses to be served by the year 2011 would be 212000. **Therefore, adopting the yardstick of one part time waste collector per 200 units, the number of part time waste collectors would be 1060 to cover all the houses, shops and establishments on a day to day basis.** These persons will have to be given a weekly off and replacement will have to be made on that day to keep the system going round the year.

5.3.3 Role of the Waste Collector

The waste collector should ring the bell or blow the whistle announcing his arrival at the place of his work and start collecting the waste from the doorstep. The people may be directed that on hearing the bell/ whistle, they should put their domestic biodegradable waste as well as recyclable waste into the separate compartment of the handcart/tricycle of the waste collector or hand over the waste to him.

At places where it is not convenient for the householders to deposit the waste in the handcart/tricycle, on account of their non-availability at home when waste collector arrives in their area, they may leave their domestic waste in domestic bins or bags just outside their house on the street in the morning so as to enable the waste collector to pick up the waste and put it into the handcart. No waste collector may be expected or directed to do house-to-house collection by asking for waste at the doorsteps, as this will affect his efficiency and productivity.

5.3.4 Primary Collection of waste from societies/multi storey buildings, commercial complexes

In private societies, multi storied buildings, and commercial complexes normally no sweepers are provided by City Corporation. Private sweepers are generally engaged. With a view to avoid any conflict between private sweepers and municipal appointed waste collectors and to prevent avoidable double payment, the City Corporation may arrange to collect waste from their community bins/containers only through handcarts or pick-up vans, on a daily basis and save cost of door to door collection from these areas.

List of such societies and complexes maybe separately maintained for providing community bin clearance service.

5.3.5 Collection of Waste from Slums

There are 227 slum pockets in the city having a population of 457613. The City Corporation should collect waste from slums on a day to day basis by engaging part time waste collectors @1 person/250/300 dwelling units. Performance certification by a "Local Residence Committee" may be insisted upon in such cases to ensure that slums are served like any other posh area. These houses have already been taken into account while counting the total need of manpower for door to door collection.

5.3.6 Collection-from -the door steps in posh residential areas

In posh residential areas where the residents might not be willing to bring their waste to the municipal handcarts, collection from the doorstep may be introduced for picking up of wastes from households daily on full cost recovery basis and an NGO or contractor may be encouraged to provide such service.

5.3.7 Collection of Waste from Shops and Establishments

Shops and establishments normally open after 9am.

Waste collection from commercial areas may be organized between 9.00am and 1.00pm by using containerized push carts @one handcart per 200/250 shops and establishments.

5.3.8 Need of handcarts/tricycles for door to door collection

Looking to the number of dwelling units and commercial establishments in the city, it is proposed to procure one handcart per 200 households in congested areas and one tricycle per 200 households/shops/establishments in other areas of the city. The proportion of the same could be 30/70. Looking to the potential of population growth till 2011, (JnNURM period), it is suggested to procure 300 handcarts and 800 tricycles for door to door collection of waste.

5.3.9 Collection of Hotel and Restaurant Waste

There are 351 hotels and guest houses and 287 restaurants in the city. The hotels and restaurants may make their own arrangements for collection of waste through their own association, or the City Corporation may extend help in primary collection of such waste by deploying its own manpower and machinery for door step collection of such waste on full-cost recovery basis. The cost could be recovered on pro-rata basis. This doorstep service may be contracted out by the City Corporation if so desired. If the city desires to provide this service on cost recovery basis, it may procure at least 6 vehicles to cover all the hotels and restaurants on a daily basis and one spare vehicle to meet the replacement whenever required.

Charges for the collection of hotel waste may depend upon the quantity of waste to be picked up from the hotels and restaurants and frequency of collection required.

The cost recovery may be planned according to the classification of hotels/ restaurants in consultation with the association.

5.3.10 Vegetable, Fruit, Meat Markets Waste

These wastes should be removed on a daily basis through a contractor on full cost-recovery basis. The market association should be involved in the apportionment of the fees between the members.

The large containers kept in the fruit and vegetable markets should properly be emptied during non-peak hours and the waste from meat and fish markets should be collected through a closed pick-up van service by engaging a contractor, or departmentally as deemed expedient by the City Corporation.

5.3.11 Collection of garden waste

The waste stored in public and private parks, gardens, lawn plots etc. should be collected on a weekly basis by arranging a rotation for collecting such waste from different areas, on different days to be notified to the people to enable them to trim the trees and lawns accordingly and keep the waste ready. This waste may be collected through a contractor. Cost recovery shall be insisted upon, based on the volume of waste collected. Monthly charge may be prescribed for this service which must cover the cost of service to make the services sustainable. Initially one vehicle may be assigned in each zone for weekly door to door collection of garden waste.

5.3.12 Collection of waste from marriage halls, community halls, etc.:

A special pick up arrangement should be made for collection of waste from these establishments daily on a full-cost-recovery basis. The cost of such collection could be built into the charges for utilizing such halls. This service may be provided preferably through a contractor or departmentally, as the City Corporation deems fit.

5.3.13 Collection of construction and demolition waste

a. The corporation may contract out the service of collecting skips given on rent for storage of construction waste and notify the rates for the same.

b. Alternately the City Corporation may collect the waste departmentally and prescribe the rate per ton for the collection, transportation and disposal of construction waste and debris and notify the same to the people.

c. To facilitate the collection of small quantities of construction and demolition waste generated in the city, suitable sites may be identified in various parts of the city and notified to the people to deposit their small quantities of construction and demolition waste. Containers could be provided at such locations.

Lifting of skips through contracting mechanism

5.4 Sweeping of Streets & Public Spaces

Daily sweeping of public streets where there is habitation or commercial activity may be ensured. Isolated pockets or streets with little or no habitation around may be taken up at regular intervals. The following measures may be taken to ensure regular sweeping of streets and public places:

5.4.1 Street sweeping to be done on a daily basis

Sweeping of the public roads, streets, lanes, by-lanes should be done daily having habitation or commercial activity on one or both sides of the street. Out of the total road lengths, 440 km high density roads and 428 km medium density roads identified in the city may be swept daily and the remaining 379 km low density roads may be further classified into development and non development areas. Whenever there is development, these roads should also be cleaned daily and where there is no development, the roads could be taken up for cleaning at regular intervals as considered appropriate. It would be enough even if it is attended twice a week. Similarly a timetable should be prepared for cleaning of open public spaces periodically in the afternoon ensures that they do not become dump yards and always remain clean.

5.4.2 Substitution of Sanitation Workers

When any sanitation worker remains absent or proceeds on leave, alternate arrangements must be made to ensure that cleaning is done as usual. Badli workers or leave reserve could be used for this purpose. Adequate leave reserve staff should

be kept to ensure that a substitute is always available and the services become reliable.

5.4.3 Tools to be given to Sweepers

Uses of appropriate tool play an important role in improving the efficiency of the work force. Presently only 977 sweepers are given traditional handcarts and 50 sweepers are given tricycles for the collection of waste, which are inefficient and inadequate. These old designed handcarts and tricycles are outdated and need to be replaced by containerized handcarts/tricycles.

Use of containerized handcart and long handled broom for street sweeping

Municipal Corporation is keen to use containerized handcarts instead of tricycles, hence use containerized handcarts is recommended. The following recommendations may be considered for procurement of tools.

5.4.4 Use of containerized Hand-Carts by street sweepers

Each sweeper engaged in street sweeping may be given individual containerized handcart/tricycle having 4/6 containers of 40/60litre capacity each as mentioned earlier.

The containers of the pushcarts should be detachable to facilitate the direct transfer of street sweepings from the container into the secondary waste storage bins. Such containers should be lockable with a chain arrangement. The handcart should have at least 3 wheels with sealed ball bearings so that it can be used efficiently. The design and specifications of the handcart are given in Annexure – 11 and that tricycle is given in Annexure-12.

5.4.5. Metal Tray and Metal Plate

Each sweeper engaged in street sweeping should be given a metal tray and a metal plate for facilitating easy transfer of street sweeping from the streets into the handcart. The design and specifications of the same are given in Annexure -16.

5.4.5 Pairing of male and female workers

In case due to resistance from the women workers, it is felt that women workers need not be given handcarts and they may be allowed to do only the street sweeping and male workers should transfer the waste to the container, a male- female pair may be formed by giving double length for street cleaning to each female worker and the male worker pairing with her may be asked to pick up the waste so collected by the street sweeper in his handcart/tricycle and take the waste to the container.

5.4.6 Norms of Work for Street Sweepers

Street Sweepers should be assigned fixed individual beats ("Pin point" work) according to the density of the area to be swept. The yardstick of work may be prescribed as under as soon as door to door collection is made operational and effective.

Table 21: Work norms for street sweeping

Density	Work norms for single worker	Work norms for the pair
High density area	500 running metres (RMT) of road length	1Km
Medium density area	750 running metres (RMT) of road length	1.5Km
Low density area	1Km running metres of road length	2Km

Looking to the above norms and the density of roads in the city, the sweepers may be assigned the work as under.

Table 22: Road length and allotted number of street sweepers

Density	Road length in km	No. of sweepers required
High density	440	880
Medium density	428	571
Low density (alternate day)	379	190
	1247	**1641**

Presently 1650 sanitation workers are deployed for street sweeping. This figure is adequate.

Roads, which have a central verge or divider, should be considered as two roads. In such cases the length of the road allotted for sweeping should be reduced to half or alternatively separate sweepers may be engaged for sweeping two sides of the road.

The yardstick for cleaning open spaces should be prescribed based on local conditions. However, 30,000sq. ft. of open space can be given to a sweeper for cleaning per day.

Once the system of door to door collection becomes effective, the norms of work

should be reviewed suitably.

5.4.7 Requirement of handcarts for street sweeping

The requirement of handcarts for highly congested areas can be put at 300 (1 per pair of workers) and tricycles at 600 (1 per pair) for medium and low density areas. The total requirement of handcarts can be put at 300 and tricycles at 600 for the purpose of street sweepings.

5.4.8 Cleaning the slums

The above sweeping norms are for cleaning the streets in the first 4 hours of the working day. In the remaining hours of the day, the sweepers should be assigned pin point work for cleaning the streets in slums and unauthorized settlements to ensure hygienic conditions in the city and prevent the problems of health and sanitation arising in such areas.

5.4.9 Cleaning of Surface Drains

In many part of the city there are open surface drains on both sides of the road, into which quite often the sweepers and the public dispose of waste in an un-authorized manner. These drains need to be cleaned on a regular basis to permit free flow of wastewater. Sweepers and citizens may be educated not to dispose of any waste into drains. Whatever waste is removed from the drains should not be allowed to remain outside the drain for long for drying. It would be desirable to deposit the wet silt into a seamless handcart as soon as it is taken out from the drain. If that be not possible or found difficult, the silt may be allowed to dry for about 4 hours outside the drain before transporting the semi-solid silt for disposal. In special situations a maximum of 24 hours should be allowed for removal of such waste. Seamless handcarts may be used for transfer of silt from the surface drain site to the waste storage depot. Shovels should be used for transferring the contents from the seamless handcart or tricycle to a larger container kept at the temporary storage depot. The corporation may use the existing 400 traditional handcarts for collection of waste from the drains.

5.4.10 Removal of Silt from Underground Drains/Manholes

The work of removal of silt from underground drains or manholes, storm water drains or surface drains deeper than 24", should be done by the Engineering Division of the City Corporation and this work should not be entrusted to the SWM department. The silt so removed should not be kept on the road/footpath for drying. This waste should be removed on the same line as suggested for silt removed from the surface drains. This waste should not be taken to the compost plant, but may be taken to landfill directly through transfer station.

5.4.11 Provision of Litterbins

Varanasi has a large floating population which increases dramatically on festival days. The floating population as well as the local population visiting religious and historical places as well as places of public entertainment, markets, etc., generate waste and in absence of litter bins dispose of this waste on the streets. While introducing the system of door to door collection and prohibiting littering on the streets, it is necessary that municipal corporation provides litter bins at all strategic locations that Ghats, temples, market places, places of entertainment, etc., and arrange to educate the citizens to use this facility instead of littering on the streets. The facility of litter bins may be provided at a distance ranging from 25 metres to 100 metres.

The removal of waste from these litterbins should be done by the respective street sweepers during their street cleaning operations. The waste from the litterbin should be directly transferred into the handcart/tricycle of the sweeper.

A litterbin placed in a public park.

Such facilities can be created at no cost to the City Corporation by involving the private sector and giving them advertisement rights on the bins for a specified period or by allowing them to put their name on the bins as a sponsor.

Initially the corporation may provide 500 litterbins at strategic locations and its use may be propagated and monitored. Later this facility may be extended to cover the entire city.

5.5 Abolish Open Waste Storage Sites and Covered Masonry Secondary Waste Storage Depots and replace the same by Metal Containers

Overflowing of dust bins and heaps of garbage lying unattended at open waste storage depots is a serious problem faced by most of the ULBs in India. To tide over this problem, the MSW Rules 2000 mandate the following.

i. **Storage facilities shall be created and established by taking into account quantities of waste generation in a given area and the population densities.**

A storage facility shall be so placed that it is accessible to users.

ii. **Storage facilities to be set up by municipal authorities are any other agencies shall be so designed that wastes stored are not exposed to open atmosphere and shall aesthetically acceptable and user-friendly.**

iii. **Storage facilities or "bins" shall have "easy to operate" design for handling, transfer and transportation of waste. Bins for storage of biodegradable waste shall be painted green, those for storage of recyclable waste shall be painted white and those for storage of other wastes shall be painted black.**

iv. **Manual handling of waste shall be prohibited. If unavoidable due to constraints, manual handling shall be carried out under proper precaution with due care for safety of workers.**

5.5.1 Use of existing Dhalaos suitably and construction of new depots to meet the need of the city

The Corporation has been using 20 large covered dhalaos, 27 open waste storage sites and 65 metal containers for storage of waste. These 120 sites are wholly inadequate to meet the secondary waste storage requirements of the city. The sanitation workers presently need to travel a long distance carrying the waste. This reduces productivity. Besides, the waste is deposited on the ground as shown earlier causing unsanitary conditions. All these dhalaos and open waste storage sites need to be replaced by closed body metal containers at strategic locations. The "Dhalao's" front wall may be removed allowing the shed to continue and containers may be placed on a concrete floor inside the Dhalao wherever possible. In rest of the site, the containers may be placed on a concrete floor having screen walls on two sides.

5.5.2 Need to store street sweepings separately from organic waste

Keeping in view the mandatory direction under MSW rules to treat the organic waste before disposal, it is considered essential to ensure that the domestic waste collected from households through waste collectors should not be allowed to be mixed with street sweepings which are by and large inert and would result in the contamination of the organic matter separately collected for composting. The mixing of street dust with organic matter will reduce the quality of compost and add burden of segregation at the plant site. It is, therefore, recommended that the organic waste collected from the doorstep should be stored separately, the recyclable waste collected from the doorstep may be allowed to be taken away by the waste collector to earn an additional living by sale of recyclable material and the street sweeping separately collected by street sweepers may be stored in separate small size black containers kept besides the green containers so that the stream of organic and inert waste can be kept separate. The green containers can directly go to compost plant and black containers when full can be taken to waste disposal site. In furtherance to the above concept of segregating organic and inert at the waste storage depot, ward-wise

situation analysis has been carried out and need of each ward has been identified in consultation with ward level supervisors. Based on the consultation, it is proposed to introduce pairs of green and black color containers of 7Cu.M and 3.5Cu.M respectively for secondary storage of biodegradable waste and inert street sweeping respectively as shown in photograph below.

Two Separate Containers for biodegradable and street sweepings

One of these containers would be small of 3.5 M^3 and painted black whereas one or more containers as per the local need will be of 7M^3 and painted green.

5.5.3 Estimated need of containers

Containers are to be placed all over the city in a way that sanitary worker has not to walk more than 250 m for depositing the waste in the secondary storage bin. The distance between two bins is therefore proposed to be kept within 500m from each other .This necessitates minimum 4 locations of secondary storage per sq.Km in the city The city has varying density of population . In high density areas more containers are required to be placed where as in low density areas even though the quantity of waste is small, 4 sites have to be identified per sq.Km for secondary storage of waste. With a view to minimize the cost of secondary storage bins and their transportation ,large size bins of 7 Cu.M may be placed in high density areas and in low density areas 3.5 Cu.M containers may be placed for the secondary storage of organic waste and all these containers may be lifted each day.

To avoid any mix up of biodegradable waste with inert waste, green bins may be used for bio degradable waste and black bins may be used for inert waste in terms of MSW Rules 2000 and National Manual on Solid Waste Management .The green and black bins may be put together as a pair so that no sanitation worker may be tempted to put waste in other bin closer to him..

Keeping in view the need of adequate storage capacity and to avoid any overflow of waste, a serious consultation was made with all field officers and assessment of the need of containers in various sanitation wards have been made and the locations where a pair of containers or more than two containers could be placed in replacement of the existing masonry or open waste storage depots have been determined. The zone wise and ward wise requirement of green and black containers have been worked out as shown in table below.

Table 23: Zone & ward-wise requirement of Secondary Waste Storage Containers

S. No.	Name of the zone	Name of the ward	No. of green containers	No. of black containers required	Total
1	Dashaswamegh	Dashaswamegh	11	6	17
		Chetgunj	22	13	35
		Sigra	39	31	70
2	Kotwali	Chowk	13	3	16
		Kotwali	23	8	31
3	Bhelupur	Bhelupur	14	8	22
		Khojwa	33	29	62
		Nagwa	28	23	51
4	Varunapar	Sikrol	39	25	64
		Shivpur	27	21	48
		Nadeshar	23	18	41
		Sarnath	25	22	47
5	Adampur	Adampur	16	14	30
		Jaitpura	26	18	44
			339	**239**	**578**

Assuming 10% recyclable waste will get segregated at source and about 12.5% waste will get collected as street sweepings, these 339 green containers will have to accommodate about 560 Mt waste to be collected from the door step .To meet this requirement, 150 containers of 7m^3 may be placed in high density areas and 189 containers of 3.5 m^3 capacity may be placed in low density areas. Besides, 239 black containers of 3.5 m^3 capacity may be placed for storage of street sweeping waste. All the green containers will have to be lifted each day as no additional capacity is allowed to be created by CPHEEO.

The locations where the containers are proposed to be placed have been determined after detailed deliberations with the sanitary inspectors and the health officers by the municipal commissioner and the team of consultants.

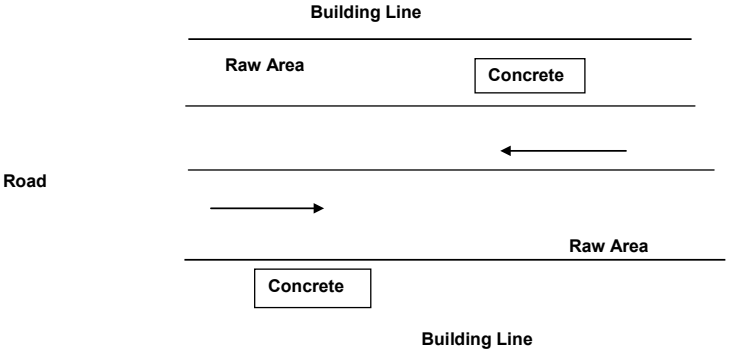
The design and specifications of green and black containers are given in Annexure-13 and Annexure-15.

5.5.4 The number of containers already existing with the municipal corporation

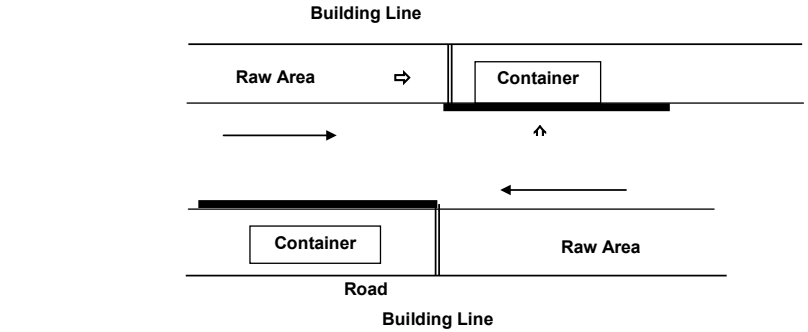
Corporation has already procured 65 metal containers of 4.5M^{3}capacity. The requirement of 3.5 Cu.M containers, therefore, gets reduced by 65 containers and comes down to 124. The municipal corporation is, therefore, required to procure 150 green containers of 7M^3 , 124 green containers of 3.5 M^3 and 239 black containers of 3.5M^3 capacity to meet the requirement of the city.

5.5.5 Placement of bins on the road side

The bins could be placed on the road side as under. The sites that have been identified for keeping the containers may be paved. The flooring should be of cement concrete. The flooring should be having adequate length and width according to the position as shown in the diagram below.



On broad roads two screen walls of 5 ft. 6 inches height may be erected in such a way that the view of the container is blocked for the people traveling in vehicles on the road as shown in the diagram below and the bin may be cleared by the dumper placer vehicle from the side of the road without obstructing the traffic.



⇨ **Shows screen walls**

5.5.6 Need of a center for collection of hazardous domestic waste.

It is essential to ensure that domestic hazardous waste listed earlier is not mixed with biodegradable waste or recyclable waste so that it does not affect the quality of compost or recycling process. With a view to handle such waste carefully, citizens may be educated to keep such waste separately at home or at their establishment and deposit the same at a hazardous domestic waste collection center which maybe established in the city by the corporation. One ward office muster station in each zone which is centrally located may be notified for depositing domestic hazardous waste and facility may be provided at that center to receive variety of domestic hazardous waste in different compartments.

5.6 Transportation of waste

Mandatory provision on transportation of waste under the Municipal Solid Waste (Management & Handling) Rules 2000 is as under.

Vehicles used for transportation of waste shall be covered. Waste should not be visible to public nor exposed to open environment preventing their scattering. The following criteria shall be met viz.:

(i) The storage facility set up by the municipal authority shall be daily attended for clearing of waste. **The bins or containers wherever placed shall be cleaned before they start overflowing.**

(ii) **Transportation vehicles shall be so designed that multiple handling of waste, prior to final disposal, is avoided.**

The system of transportation should be such that it can be easily maintained in the city departmentally or through private garages and the system should appropriately match with the system adopted for the storage of waste at the dust bin site i.e. at the temporary waste storage depots. Manual loading should be discouraged and phased out expeditiously and replaced by direct lifting of containers through hydraulic system or non-hydraulic devices or direct loading of waste into transport vehicles.

Presently open tractors or open trucks are used in large number besides covered vehicles and a few dumper placers for transportation of waste. Use of all the open tractors and trucks need to be dispensed with and instead dumper placer machine may be used for transportation of waste as shown in photographs below. These vehicles would be very hygienic and efficient for transportation of waste.

Transportation of waste is proposed on a daily basis for all 365 days in a year, but as per the suggestions of CPHEEO all the green containers are to be lifted daily; therefore the transportation plan is suggested accordingly.

Dumper placer bin lifting system

Dumper placer container ready for transportation

The design and specifications of the dumper placer is kept at Annexure - 21

The following measures may, therefore, be taken to meet the above mandatory directions:

5.6.1 Grouping of containers

The transportation of waste from the temporary waste storage depots/sites may be planned in accordance with the frequency of containers becoming full. The locations where the containers are placed may be grouped into four categories as under:

a. Containers which are required to be cleared more than once a day.
b. Containers which are required to be cleared once a day.
c. Containers to be cleared on alternate days.
d. Containers which take longer time to fill and need clearance twice a week.

5.6.2 Routing of vehicles

All the vehicles may be taken to the respective transfer station for unloading green and black containers separately into a large hauling vehicle. Each dumper placer vehicle will make a minimum of 6 trips to the transfer station in one shift.

5.6.3 Estimated need of vehicles for transportation of containers

All the green containers having biodegradable waste need to be transported each day as per the insistence of CPHEEO and therefore need of vehicles is worked out for transport of all green containers each day. The black containers having inert waste may be lifted once in a week. The need of vehicles has been worked out accordingly as under making a provision of 10% spare vehicles to ensure reliability of service during breakdown of vehicles or when they are taken up for maintenance.

Table 24: Estimated need of vehicles

Containers	Number
No. of 7 M^3 green containers to be lifted each day	150
No. of 3.5 M^3 green containers to be lifted each day	189
No. of 3.5 M^3 black containers likely to be lifted each day	35
No. of trips 1 dumper placer can make to transfer station	6
No. of vehicles required to lift 7 M^3 containers each day	25
10% spare vehicles required to maintain reliability of service	3
Total dumper placer vehicles required for green containers	**28**
No. of vehicles (twin bin lifters) required to lift 189-65=124 green 3.5 Cu.M containers each day (12 containers per shift)	11
No. of vehicles (twin bin lifters) required to lift 3.5 M^3 black containers each day	4

Total no. of vehicles (twin bin lifters) required to lift 3.5 M^3 containers each day	15
10% spare vehicles required to maintain reliability of service	2
Total no of dumper placer with twin bin lifting mechanism to be procured	**17**
No. of vehicles required to lift 65 green containers of 4.5Cu.M	12
No. of existing vehicles with the corporation	12

5.6.4 Transportation of waste from hotels & restaurants

The hotels and restaurants waste should be collected once or twice daily through a contract given by the association of hotels and restaurants, or at their request by the City Corporation on cost recovery basis. Doorstep collection system may be introduced for the collection of this waste. Motor vehicle with close body may be used. This entire collection and transport system should be privatized and rates may be prescribed by the association or City Corporation. Initially 6 large vehicles may be pressed into service to cover all hotels and restaurants and one spare vehicle may be kept to ensure reliable service.

5.6.5 Transportation of construction waste and debris

Skip-renting system for storage of construction waste may be introduced through private sector. The corporation may fix the rate for the same by inviting tenders from time to time. The contract may be for a minimum period of five years to attract private entrepreneurs into this business. The skips may be transported by hydraulic system at a time mutually agreed upon between the contractor and waste producer. To begin with 20 skips and 3 skip lifters may be procured and this fleet may be increased once the system gets stabilized. Design and specifications of skip and skip lifter machine are kept at annex. 17

Till such time skip renting system is introduced, waste collection fees may be levied by the corporation or by the contractor authorized by the corporation for the removal of construction waste. Such wastes may be loaded into the trucks by using front-end loader with a combination of open three trucks, which can easily transport 100 to 150 M. T. of construction waste in one shift. Corporation may use hired JCB machines and tipper trucks for this purpose or contract out this service.

5.6.6 Transportation of waste from narrow lanes

Varanasi city being one of the oldest cities of the world has several very narrow lanes leading from the city to the Ghats. No vehicles can move into to several narrow lanes. Therefore, hopper type small vehicles may be used for such lanes to the extent possible to transfer the waste from tricycles to the hopper and bring that waste and take that waste to the transfer station nearby and directly put the waste in a large

hauling vehicle instead of transferring the waste into the container. This situation is mainly prevalent in Dashaswamegh and Kotwali wards for which 25 hopper vehicles (loading rickshaw) may be initially procured.

5.6.7 Workshop facility for vehicle maintenance

The workshop is the backbone of solid waste management system. If fleet of vehicles and equipment are not properly maintained, the solid waste management services would suffer substantially. The municipal corporation should therefore have an efficient workshop facility where all minor repairs and maintenance could be carried out departmentally and major works could be outsourced by having contractual arrangements for the maintenance of fleet of vehicles. The corporation should therefore identify a good garage within the city which can take up major repairs of the vehicles and equipment that are proposed to be procured in this report. It is however recommended to invest on workshop upgradation as shown in annexure 19.

5.6.8 Regular/washing of containers and trucks

It is essential to maintain the fleet of vehicles and containers and make an arrangement of their regular washing and cleaning.

High pressure water jetty for washing the containers, bins and basket and service station for washing the lorry is recommended and the same is covered in workshop upgradation.

5.7 Transfer stations

The City of Varanasi does not have an engineered landfill or a treatment plant. The waste is presently being dumped on the bank of a tributary Varuna of River Ganges and partly on a private land. Both these sites are totally unsuitable for disposal of waste. Unfortunately, the city corporation has no land identified for setting up treatment or disposal facility. It is, therefore, exploring the possibility of involving private entrepreneurs taking up the task of treatment and disposal of waste on their own land and accordingly identified few parties having suitable lands at a distance of about 20Km from the city where the treatment and disposal facility is likely to be set up.

As the distance of the treatment plant/disposal site is to exceed 15 km, it is not considered advisable to take all the waste in small vehicles and containers to the disposal site. For optimum utilization of the small vehicles and reducing the cost of transportation, **it is necessary to set up at least two transfer stations for bulk transfer of waste from different parts of the city to the treatment/disposal site.**

The consultants have looked at various sites along with the municipal commissioner

and senior officials of the corporation for setting up transfer stations and have finally zeroed down on two locations as under. Plot No. 256 at Village Bhikharipur, Kalan Pargana Dehat, Varanasi admeasuring 1.5acre and another land plot No. 1 at Village Kila Kohava Pargana Dehaet, District Varanasi admeasuring 1.03 acres as shown in the map.

5.7.1 Design of Transfer Station

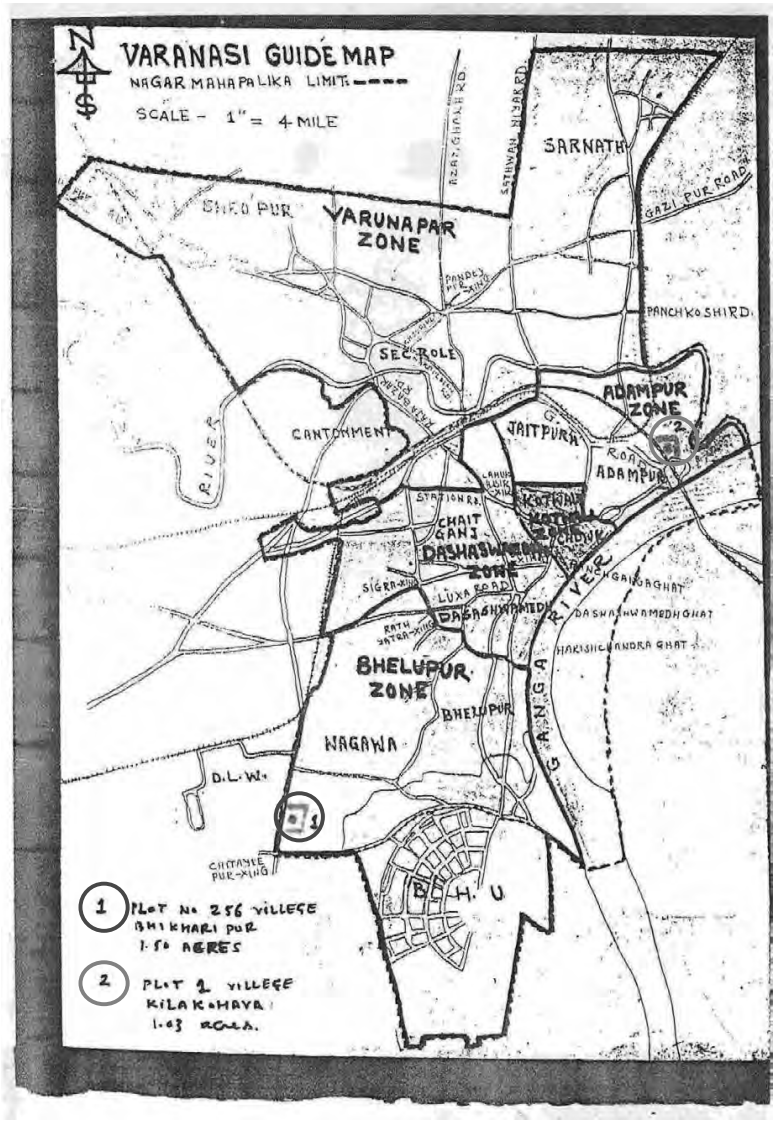
The design of transfer station is based on a simple ramp model transfer station with the facility for computerized weigh bridge and compactors. The design of the transfer station is prepared in such a way that dumper placer machines and small hopper vehicles can go over a ramp to a higher level and directly tip in a large tipping truck of 27M^3 capacity kept at a lower level so that multiple handling of waste can be avoided and time also can be saved in transfer of waste from the city to the disposal site as could be seen from the photograph below.

Direct transfer of waste from small vehicle to a large vehicle

It is proposed to have an office at each transfer station to maintain the records of the waste brought by each vehicle and shifted to the treatment/disposal site.

It is also proposed to have a computerized weighbridge at each transfer station to maintain up to date records of the waste received from various wards and the quantity of waste brought by each vehicle.

Map Showing Location of the Proposed Transfer Stations



5.7.2 Costing of the Transfer Station

The detailed cost estimation for construction of Transfer station is given below:

Memorandum showing items of work to be carried out

SCHEDULE - "B"

Table 25: Civil Work for Transfer Station

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
	Excavation in Earth, soil of all types, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed ***for Footings*** and necessary backfilling, ramming, watering including shoring and strutting etc complete upto depth-1.5 M				
1	As per schedule of rates, Varanasi	Cum	1284.00	30.00	38520.00
	Filling in plinth and floors with approved excavated materials in 15-20cm depth including watering and compaction complete.				
2	As per schedule of rates, Varanasi	Cum	770.40	30.00	23112.00
3	Retaining wall				
	Providing and laying in situ 1:2:4 lime concrete, with trap/granite/quartzite/gneiss broken stone aggregate for foundation including bailing out water form work, compacting and curing complete.				
(a)	As Per Schedule of rates, Varanasi	Cum	28.35	605.00	17151.75
	Providing & Laying 300MM thick Dry Rubble Soling at base in 1:4 cement sand mortar, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
(b)	As Per Schedule of rates, Varanasi	Cum	170.10	1504.00	255830.40
	Providing & Laying in site Cement Concrete in 1:5:10 for retaining wall, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
(c)	As Per Schedule of rates, Varanasi	Cum	85.05	1080.00	91854.00
	Providing Plum Concrete in ratio 1:3:6, with cement concrete and stone boulders not more than 150mm equally for retaining wall including bailing out water, formwork, compacting curing complete.				
(d)	As Per Schedule of rates, Varanasi	Cum	1980.75	1292.00	2559129.00
4	Providing compacted soil with approved materials obtained from departmental land or other sources including all lifts, laying in layers of 20 cm to 30 cm thickness breaking clods, dressing to the required lines, curves, grade and section, watering and compaction to 95% of Standard Proctor Density, complete with Vibratory Power roller, etc. complete.				
	As per schedule of rates, Varanasi	Cum	11700.00	190.00	2223000.00
5	Providing & Laying 100MM thick Dry Rubble Packing at base in 1:4 cement sand mortar, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
	As per schedule of rates, Varanasi	Cum	990.00	1504.00	1488960.00
6	Providing & Laying 100MM thick Stone Aggregate of trap/granite/gneiss metal including bailing out water, formwork, compacting curing complete.				
	As per schedule of rates, Varanasi	Cum	330.00	140.00	46200.00
7	Providing & Laying in site Roller Cement Concrete of trap/granite/gneiss metal including bailing out water, formwork, compacting curing complete.				
	As per schedule of rates, Varanasi	Cum	330.00	1120.00	369600.00
8	Providing & laying design mix cement concrete M20 for platform having a minimum works test beam flexural strength of 30 kg per sqcm at 28 days using not less than 340 Kg. of cement per cum of finished concrete, coarse sand and graded stone aggregate of 40mm nominal size in appropriate proportions as per specified design criteria approved by Engineer-in-charge mechanically viabrated using needle & surface vibrators including steel form work with strudy M.S.channel sections including curing and providing & filling construction joints and dummy joints with shalijjet primer or equivalent including rounding of the edges and filling and filling the grooves 10X25mm deep at top for construction joints and 10X50mm deep at top for dummy joints with joint sealing compound (confirming to grade B of IS:1834) including making expansion joints etc. all complete.				
	As per R.A.	Cum	660.00	3500.00	2310000.00

9	Providing expansion joints in P.C.C. platform with 8mm thick and 200mm deep expanded polyethylene (E.P.) sheet and bitumen joint filler etc. completed as directed below: a) Place the E.P.sheet strips at required position at the time of placing P.C.C. b) After initial setting of PC.C. remove the top portion of E.P. sheet upto 25mm depth. c) Fill the groove with bitumen joint filler (cold treatment).				
	As per R.A.	Rmt	1800.00	46.00	82800.00
10	Providing & Laying 450mm thick Dry Rubble Soling at base in 1:4 cement sand mortar, of trap/granite/gneiss metal for drainage purpose including bailing out water, formwork, compacting curing complete.				
	As per schedule of rates, Varanasi	Cum	464.04	1504.00	697916.16
			Total Amount		**10204073.31**

Table 26: Weigh Bridge Office @ Varanasi

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	***Excavation*** in Earth, soil of all types, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed ***for Footings*** and necessary backfilling, ramming, watering including shoring and strutting etc complete upto depth-1.5 M				
	As per schedule of rates, Varanasi	Cum.	99.72	30.00	2991.45
2	***Backfilling*** with 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, lead upto 50m and lift upto 1.5m etc.complete.				
	As per schedule of rates, Varanasi	Cum.	59.83	30.00	1794.87
3	Providing & Laying in situ Cement Concrete in 1:4:8 ***for Bed for Footings,*** of specified grade excluding the cost of centring and shuttreing including bailing out water, compacting, curing complete.				
	As per R.A.	Cum.	3.11	1102.00	3425.02

4	Providing & Laying in situ Cement Concrete in 1:1.5:3 ***for Strip Foundation*** of specified grade excluding the cost of centring and shuttreing including bailing out water, compacting, curing complete.				
	As per R.A.	Cum.	3.89	2339.00	9087.02
5	Providing & Laying in situ Cement Concrete in 1:1.5:3 ***for Plinth Level Band Beams*** of specified grade excluding the cost of centring and shuttreing including bailing out water, compacting, curing complete.				
	As per R.A.	Cum.	0.89	2339.00	2090.01
6	Providing & Laying in situ Cement Concrete in 1:1.5:3 for ***Lintel Beams*** of specified grade excluding the cost of centring and shuttreing including bailing out water, compacting, curing complete.				
	As per R.A.	Cum.	1.19	2339.00	2786.68
7	Providing & Laying in situ Cement Concrete in 1:1.5:3 for ***Roof Level Beams*** of specified grade excluding the cost of centring and shuttreing including bailing out water, compacting, curing complete.				
	As per R.A.	Cum.	1.94	2339.00	4530.25
8	Providing & Laying in situ Cement Concrete in 1:1.5:3 for ***Roof Slabs***of specified grade excluding the cost of centring and shuttreing including bailing out water, compacting, curing complete.				
	As per R.A.	Cum.	3.47	2339.00	8116.70
9	***Reinforcement for R.C.C. work*** including straighening, cutting bending placing in position and binding all complete.				
	As per schedule of rates, Varanasi	Kg.	605.21	32.15	19457.45
10	Providing & Laying in situ Plain Cement Concrete in 1:4:8 ***for Bed for Flooring,*** of specified grade excluding the cost of centring and shuttreing including bailing out water, compacting, curing complete.				
	As per R.A.	Cum.	2.31	1102.00	2549.41

	2.5cm thick 1:2:4 plain cement concrete floor with cement, approved coarse and 2 cm. Graded approved stone ballast laid in panels finished with 3mm floating coat of neat cement or cement and marble dust in ratio of 5:1 as specified over and including 8cm thick base concrete consisting of cement, local sand and brick ballast 4cm. Gauge in the proportion of 1:4:8 and removing any overlapping mortar at the joints of the panels if any and giving them a uniform finish, including supply of all materials, lab our, T&P etc. required for proper completion of the work.				
11	As per schedule of rates, Varanasi	Cum.	23.13	160.00	3701.50
	Providing ***Brick work*** for 350 mm Thk for foundation, with Modular bricks of class designation 75 in foundation in cement mortor 1:6, including bailing out water, striking joints on unexposed faces, racking out joints on exposed faces & watering,				
12	As per schedule of rates, Varanasi	Cum.	22.66	1280.00	29008.00
	Providing ***Brick work*** for 230 mm Thk with Modular bricks of class designation 75 in superstructure above plinth in cement mortor 1:6, including bailing out water, striking joints on unexposed faces, racking out joints on exposed faces & watering,				
13	As per schedule of rates, Varanasi	Cum.	14.42	1280.00	18458.88
	Providing Rough Cast ***Cement Plaster with a floating coat of neat cement*** in single coat ***for Inside surfaces*** to concrete or brick masonry surface, in all positions with minimum 12mm thick in Cement plaster of mix 1:4 including scaffolding and fourteen days curing complete.				
14	As per schedule of rates, Varanasi	Sqm.	90.27	42.00	3791.52
	Providing Rough Cast ***Cement Plaster*** in two coats ***for Outside surfaces*** to concrete or brick masonry surface, in all positions with minimum 20mm thick in Cement plaster of mix 1:2 including scaffolding and fourteen days curing complete.				
15	As per schedule of rates, Varanasi	Sqm.	79.40	75.00	5955.00

	Distempering with dry distemper of approved brand & manufacture (two or more coats) & of required shade on new work, over & including priming coat of whiting to give an even shade.				
16	As per schedule of rates, Varanasi	Sqm.	90.27	27.10	2446.44
	Providing & applying ***Water proofing cement paint*** "Snowcem - Plus" of M/s Snowcem India Ltd., or equivalent of required shade to Outside wall surfaces:- New work (Two or more coats applied @ 3.84 Kg/10 Sqm)				
17	As per schedule of rates, Varanasi	Sqm.	79.40	20.40	1619.76
	Providing ***steel work in frames*** of doors, windows, ventilators, wrought framed & in position for Sal Wood				
18	As per R.A.	Cum.	0.18	889.00	162.95
	Providing & fixing ***panalled or panelled & glazed shutters*** for doors, windows, ventilators including ISI marked black enamelled M.S. butt hinges with necessary screws excluding, panelling which will be paid for separately.- For thicness of shutters 30mm for Second class Teak Wood				
19	As per R.A.	Sqm.	15.00	1931.00	28965.00
			Total Amount		**150937.92**

Table 27: Civil Work for Tar Road @ Varanasi

Width of Road **17.00** **M**
Length of Road **348.00** **M**

A) Civil Work

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	***Excavation*** in Earth, soil of all types, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed ***for Platform*** and necessary backfilling, ramming, watering including shoring and strutting etc complete upto depth-1.5 M				
		Cum.	887.40	30.00	26622.00
	Dry Brick pitching half brick thick for base including supply of bricks and preparing the base with F.P.S. bricks of class destination 75				
2		Cum.	5916.00	125.65	743345.40
3	Supply & stacking of ***Over brunt (Jahma) brick aggregate*** at site of size ***120mm to 40mm***				

		Cum.	709.92	257.00	182449.44
	Supply & stacking of ***Over brunt (Jahma) brick aggregate*** at site og size ***25mm to 50mm***				
4		Cum.	591.60	257.00	152041.20
	Laying Water bound macadam sub base with brick aggregate and blinding material, earth etc. including screening, sorting and spreading to template and consolidation with light power road-roller etc. complete (payment for bricket and moorum etc. to be made separately) - For over brunt (Jahma) brick aggregate of size ***120mm to 40mm***				
5		Cum.	709.92	89.55	63573.34
	Laying Water bound macadam sub base with brick aggregate and blinding material, earth etc. including screening, sorting and spreading to template and consolidation with light power road-roller etc. complete (payment for bricket and moorum etc. to be made separately) - For over brunt (Jahma) brick aggregate of size ***25mm to 50mm***				
6		Cum.	591.60	89.55	52977.78
	2cmPremix Carpet Surfacing with 2.4 cum of stone chippings 11.2 mm nominal size per 100 sqm and bitumen emultion (medium setting min 65% bitumen content) complying with IS : 8887-1995 using 96 kg per cum of chipping including consolidation with road roller of 6 to 9 tonne capacity etc. complete.(tack coat to be paid separately)				
7		Sqm.	5916.00	48.80	288700.80
	Providing & laying ***Seal Coat*** of premixed fine aggregate (passing 2.36 mm and retained on 180 micron sieve) with bitumen using 128 kg of bitumen of grade 80/100 bitumen per cum of fine aggregate and 0.60 cum of fine aggregate per 100 sqm of road surface including rolling and finishing with road roller all complete.				
8		Sqm.	5916.00	19.30	114178.80
			Total Amount		**1221009.16**

Table 28: Civil Work for Weigh-Bridge Varanasi

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
	Excavation in Earth, soil of all types, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed ***for Footings*** and necessary backfilling, ramming, watering including shoring and strutting etc complete upto				
1	depth-1.5 M				
	As per schedule of rates, Varanasi	Cum.	86.44	30.00	2593.29
	Filling in plinth and floors with approved excavated materials in 15-20cm depth including watering and compaction				
2	complete.				
	As per schedule of rates, Varanasi	Cum.	48.03	30.00	1441.04
	Providing & Laying in situ Cement Concrete in 1:4:8 ***for Bed for Bottom Raft,at foundation plate level and ramp*** of specified grade including the cost of centring and shuttreing including bailing out water, compacting,				
3	curing complete.				
	As per R.A.	Cum.	16.24	1102.00	17899.68
	Providing Earthwork below ramp with approved materials obtained from departmental land or other sources including all lifts, laying in layers of 20 cm to 30 cm thickness breaking clods, dressing to the required lines, curves, grade and section, watering and compaction to 95% of Standard Proctor Density, complete with Vibratory Power				
4	roller, etc. complete.				
	As per schedule of rates, Varanasi	Cum.	25.01	190.00	4751.66
	Providing & Laying in situ Cement Concrete in 1:1.5:3 ***for Bottom Raft, Walls, Columns*** of specified grade including the cost of centring and shuttreing including bailing out water,				
5	compacting, curing complete.				
	As per R.A.	Cum.	10.61	2339.00	24811.88
	Reinforcement for R.C.C. work including straighening, cutting bending placing in position and binding all				
6	complete.				
	As per schedule of rates, Varanasi	Kg.	641.57	32.15	20626.37
	Providing second class burnt brick masonary with conventional / I.S. type bricks in cement 1:6 in superstructure including striking joints, raking out				
7	joints, waterig & scaffolding complete.				
	As per schedule of rates, Varanasi	Cum.	2.54	1280.00	3244.80
			Total Amount		**75368.71**

Table 29: Total cost of Transfer Station

S.No	Item	Amount
1	Weigh bridge office	150937.92
2	Weigh bridge civil	75368.71
3	Tar road	1221009.16
4	Transfer station civil	10204073.31
5	Compound wall civil	957701.39
6	Compactors	600000
7	Weigh bridge	1000000
8	High Pressure Water Jetty for Washing Containers/ bins /lorries at transfer stations	10,00,000
Total Amount		**15209090.49**

5.7.3 Need of large hauling vehicles for the transfer station.

For transferring 600 MT of waste at the treatment and disposal site 20 KM away the need of vehicles and equipment works out as under.

Table 30: Need of large hauling vehicles

Type of vehicle to be used	**27M^3**
Quantity of waste each vehicle will carry in one trip	12 MT
No. of trips required to be made to the disposal site for carrying 600MT in 2007 and 735 MT by 2011.	50
No. of trips each vehicle will make to treatment/disposal site	3
No. of vehicles required for transportation of waste to the treatment plant.	17
No. of standby vehicles required (25%)	4
Total hauling vehicles	**21**
No. of large hauling vehicles available with the corporation	**2**
No. of vehicles now required	**19**

The design and specifications of 27M^3 tipper truck is given in Annexure – 20.

5.8 Processing of waste

5.8.1 Mandatory direction under Municipal Solid Waste (Management and Handling) Rules 2000

The above rules make it obligatory for the corporation to adopt following compliance criteria.

Processing of Municipal Solid Wastes

(i) Municipal authority shall adopt suitable technology or combination such technologies to make use of wastes so as to minimize burden on landfill. Following criteria shall be adopted, namely:-

(ii) The biodegradable waste shall be processed by composting, vermi

composting, anaerobic digestion or any other appropriate biological processing for stabilization of waste. It shall be ensured that compost or any other end product shall comply with the standards as specified in Schedule 4 of the rules.

(iii) Mixed waste containing recoverable resources shall follow the route of recycling. Incineration with or without energy recovery including pellatization can also be used for processing wastes in specific cases. Municipal authority or the operator of a facility wishing to use other state-of-the-art technologies shall approach the Central Pollution Control Board to get the standards laid down before applying for grant of authorization.

Several technologies are being advocated by private entrepreneurs for the processing, treatment and/or disposal of municipal solid waste. Some have Indian experience such as microbial composting, vermi composting, biomethanation, fuel pellatization, etc., whereas some are based on applications in foreign countries which are yet to be tried successfully or have failed in India.

The following criteria could be adopted when selecting waste processing and disposal technologies:-

1. Indian experience or proven foreign technology suitable under Indian conditions.
2. Capital investments required.
3. Requirement of land, water and power.
4. Recurring expenditure.
5. Economy of operation.
6. Manpower needs.
7. Level of skill required.
8. The capability of the City Corporation to manage such facility departmentally or through private sector participation.
9. Scale of operation.
10. Environmental impact of such technology.
11. Process aesthetics.
12. Cost of end products.
13. Compatibility of cycle of nature.

5.8.2 Options available to City Corporation

5.8.2.1. Composting

Composting is a slow natural process in which mixed bacteria, fungi, insects and worms consume plant and animal wastes and convert them slowly to a soil-like substance very beneficial to plant growth. Compost provides energy, minerals, nutrients and micro-nutrients, useful microbes and water-retaining humus to soil.

This improves the quality and pest-resistance of produce, makes crops drought-resistant and decreases irrigation water requirements. The use of compost to enrich the soil, along with chemical fertilizer in a balanced ratio, is therefore very necessary. This view has been repeatedly expressed by government bodies as well as the fertilizer association for over a decade. Compost can find a good market if properly promoted and made conveniently available to the farming community.

Composting can be done by aerobic and anaerobic processes. The aerobic windrow process can now be completed in 45-60 days, on any scale, even with mixed non-toxic wastes, by repeated turning and aeration.

Vermi-composting is a process in which earthworms consume decayed plant and animal wastes with the help of bacteria in their gut, to excrete fine-grained soil-like vermi-castings rich in minerals and microbes very beneficial to plants and free of disease germs. Many other soil organisms assist in the breakdown and conversion of biodegradable wastes. It is best suited to segregated biodegradable wastes on a small scale in de-centralized locations.

Anaerobic composting processes are very slow. They take about 180 days to produce compost in airless pits or trenches in the ground, and generate methane, an environmentally harmful greenhouse gas. Anaerobic composting can be accelerated in biogas digesters, where the harvested methane becomes a useful fuel and the slurry produced is useful organic manure. As temperatures inside biogas digesters are not high, pathogens are not killed. It is useful for cooked-food wastes in de-centralized operations.

5.8.2.2. Incineration

This is a thermal process for burning the waste at a very high temperature. Incineration requires high calorific value waste, which can burn without any external fuels. Indian waste contains only 3 to 7% of combustible paper, plastic by the time the waste reaches the disposal site. This is principally because most of the burnable material is retrieved by rag pickers from the waste lying on the streets, dust bins and dump yards. This calorific value of Indian waste at the dump yards is found to range from 800 to 1000 Kcal/kg., which is very low.

The system of incineration is therefore not suitable under Indian conditions for this and the following additional reasons:

1. High ash and dust contents of Indian wastes.
2. The system is not environmentally friendly.
3. High capital cost, especially for adequate control of emissions.
4. High Operation and Maintenance cost.
5. The system requires high technical skill to man it.

The incineration of general municipal waste is therefore not recommended as a method of Municipal Solid Waste disposal.

Incineration of specified Biomedical waste is however unavoidable and is strongly recommended for the maintenance of health of the citizens through private sector participation.

5.8.2.3. Power Generation, Fuel Pellets, Bio Methanation Etc.

These processes are being advocated in some quarters and serious efforts are being made through research and development to generate power via high-rate bio-Methanation. Efforts are also being made to produce fuel pellets from municipal waste. A major initiative was taken at Lucknow to set up Bio-methanation plant at a cost exceeding Rs. 75 crores. The plant failed to take off as waste was not having adequate organic matter required for the successful operation of the plant. Huge investments have gone waste .Two fuel pellatization plants have also been operating at Hyderabad and Vijayawada in Andhra Pradesh for past 3 years and they are generating 6.5 MW power but success of these plants is highly contested arguing that these plants are consuming more of Agro waste rather then municipal waste. Besides, when segregation of recyclable waste will become effective as per MSW Rules, the availability of burnable matter will become less and it will adversely affect the plant. It is therefore, suggested that City Corporation should not experiment with any such expensive and unproven technology until adequate experimentation has been done successfully and Govt. of India Ministry of Non-Conventional Energy Sources, Ministry of Environment, Ministry of Urban Development or any other agency identified by Govt. of India advise to adopt such technology .

5.8.3 Choice of treatment technology

Given the technological options available for processing of municipal solid waste at the present juncture and keeping in view the composition of waste of Varanasi city, **microbial composting of organic/food and biodegradable waste is recommended**. If private sector comes forward to simultaneously set up waste to energy plant along with compost plant entirely at its own cost, it may be considered on merits.

A Compost plant with a capacity of 375 TPD is proposed for Varanasi in this DPR. A concrete yard is proposed in an area of 5 acres, as availability of land is limited. In order to get the waste processed (reducing the volume, weight etc and screening for separating non degradable), over a period of 30 days instead of 60 days, the processing machinery components are designed to treat more than 300 TPD of waste. While separating the non degradable the quantity of rejects generated will be accumulating over a vast area therefore the processing equipments like pay loaders, Tippers, Tractors etc, have also been given priority so that the treatment of

waste is continuous and accumulation of waste is avoided there by reducing the level of pollution.

5.8.4 The compost production process

It is well known fact that two types of bacteria decompose the organic matter, one is anaerobic and the other is aerobic.

The processes involved are as follows:

- Initiation and facilitation of aerobic decomposition by taking care of factors like, aeration, moisture, temperature, CN ratio and pH.
- Microbial inoculation for acceleration of decomposition and reduction of odour.
- Segregation of inert material through series of sieving process
- Enrichment process by addition of select microbial culture and other organic additives.

The final; product so produced will be black in colour, fine powdery in nature, does have earthy aroma and is completely free from pathogenic organisms and weed seeds. This product is the one, which has undergone sanitization and stabilization. This ensures pH and C: N ratio at the required levels. This is precisely due to the process methods developed indigenously by Karnataka Compost Development Corporation.

Important factors responsible for a scientific decomposition over a specific period of time are as follows:

5.8.4.1 Carbon Nitrogen ratio

The decomposition of organic matter is effected by the presence of carbon and nitrogen. As already pointed out earlier, the decomposition of organic matter is brought about by living organisms, which utilize the carbon as a source of energy and the nitrogen for building cell structures. More carbon than nitrogen is needed but if carbon is too great, decomposition decreases. In the soil, another factor enter into the series of nitrogen cycles, occurring when carbon is in great excess, it is the presence of nitrogen in the soil in a form available to bacteria. In case too great a ratio, it will result in living microbial cell's making use of the available soil nitrogen in the proper proportion. This condition is known as "Robbing' the soil of nitrogen and has the effect of delaying the availability of nitrogen as a fertilizer for growing plants. A C/N ratio of 20 has been widely accepted as the upper limit at which there is no danger of robbing the soil of nitrogen.

The optimum C/N ratio for composting therefore cannot be the optimum one for the soil. Since, the living organisms utilize about 30 parts of carbon for each part of nitrogen an initial C/N (Available quantities) ratio of 30:01 would seem most favorable for rapid composting.

5.8.4.2 Moisture content

Aerobic decomposition can proceed at any moisture content 30% to 100%, if aeration can be provided.

In practical aerobic composting, high moisture content must be avoided because water displaces air from interstices between the particles and thereby give rise to anaerobic conditions. On the hand too low moisture content deprives the organisms of the water needed for their metabolism.

The maximum moisture content for satisfactory aerobic composting will vary with the material used. Investigation indicates that the moisture content of the municipal refuse fall in the range of 40 to 60% which is most satisfactory range for aerobic composting.

Additives of various types are used with materials such as night soil, sewage sludge, garbage slop, which contain excessive amounts of moisture.

When the moisture content is too low (below 40%) it may be corrected by adding water when it is being burned.

5.8.4.3 Temperature

Proper temperature is a very important factor, particularly in the aerobic composting process. High temperature is essential for the destruction of pathogenic organisms and undesirable weed seed. The optimum temperature range is between 50°C to 70°C, around 40°C usually being the most satisfactory. The temperature increase in the mass leads to sanitization where harmful pathogens, weed seeds are killed. This is also an important one in the composting process.

5.8.4.4 Aeration

Aeration is necessary for thermo-phallic aerobic composting in order to obtain the rapid decomposition, fast decomposition that is characteristic of the process and also is useful in reducing high initial moisture content in composting materials. Several different aeration techniques have been utilized with varying degrees of success. Turning the material is the most common method of aeration when composting is done in stacks. Hand turning of the compost in piles or pits is most commonly used for small villages and farms. Mechanical turning is most economical in large municipal installations. The most important consideration in turning compost apart from aeration is to ensure that the material on the outside of the pile is turned into the

centre, when it will be subjected to high temperature. In hand turning with forks, this can be readily accomplished e.g. piles or windrows on top of the ground are simply reconstructed with the materials from the outer layers placed on the inside of the new piles. In case of composting in pits, or trenches, the material can be moved from one pit to another for aeration or if a little space is left at the end of the pit at the initial filling, the material can be turned within the pit. The loss of volume of the material during the stabilization period will facilitate turning within the pit. Mechanical equipment for turning windrows in large composting operation has been developed extensively as a result of the increased interest in composting as a method of refuse disposal.

The important criterion for the high degree of aeration is for the avoidance of anaerobic conditions, maintenance of high temperature and the control of flies.

5.8.4.5 pH Value

Decomposition will be faster at neutral; range because most microorganisms grow faster under these conditions. Under aerobic conditions, there will be a drop in pH-value initially which later begins to rise resulting in a slightly alkaline in the final stage.

Alkaline characteristics in the decomposing stage conditioned with high temperature leads to loss of nitrogen through volatilization of ammonia. This occurs mostly when composting materials have a low C/N ratio. Organic matter with pH-value of 5.5 to 8 is suitable for decomposition.

5.8.4.6 Use of Inocula

Special inocula containing several pure strains of developed, laboratory-cultured micro-organisms, which are essential in the decomposition of organic matter, can be used for accelerated decomposition and quality improvement.

Microorganism like:

⇒ Bacillus sp.
⇒ Trichoderma sp.
⇒ Aspergillus sp.
⇒ Phanerochaete sp.

5.8.5 Processing decomposed garbage

The un-segregated garbage when completely decomposed turns into black color, earthy aroma and free from pathogens. This decomposed material is passed through the process machineries, which are simple and highly effective.

Non-degradable materials like plastics, metals, glass, rubber and other inert materials are easily separated in four stages of screening. The sieving operations

eliminates bits, sticks, gravels, metals and glass pieces making the end product highly uniform in size and quality.

This end product is called “Organic Manure”. Further it is enriched using organic additives based on the recommendations of Agriculture University.

5.8.5.1 Decomposition period

Use of inocula like consortium of degrading micro organisms / cow dung solution has been recommended mainly to reduce period of decomposition to around 40 to 45 days and also to prevent foul smell and leachate generation.

5.8.5.2 Concrete yard

The concrete yard is an essential infrastructure for preventing contamination of surface/underground source of water and nearby water bodies. In the instant case the concrete yard is designed in such a way that the fresh garbage received during the first 30 days is decomposed so that the volume and weight of the organic matter is considerably reduced. Inertization is attained and the stability of organic matter is expected after 30 days. Decomposed matter is processed to obtain coarse organic manure (semi processed organic manure). The semi processed organic manure is allowed for stabilization for another 15 days and screened so that the final end product in the form of organic manure is received after passing through 4mm sieve. Such organic manure is a completely decomposed organic matter which is sanitized and stabilized.

5.8.5.3 Leachate tanks

Leachate tanks are designed in such a way that the leachate generated during the course of decomposition of organic fraction of waste is collected in the drains leading to leachate tanks. Three leachate tanks of adequate capacity are designed in order to facilitate further treatment of leachate.

5.8.5.4 Office building and laboratory

Office building is designed in such a way that it will accommodate two senior officers with separate cabins and a hall where nearly 20 officials can sit and work. Provision is also made for establishing laboratory to analyze the quality parameters of the organic manure.

5.8.5.5 Internal and peripheral roads

The internal and peripheral roads designed are only within the composting area.

5.8.5.6 Wind break trees

Wind break trees are proposed only on two sides so that the nearby habitation will

not disturb the project in future.

5.8.5.7 Water facility

Three bore wells are provided estimating 15,000 liters of water/ day. The sump will hold 10,000 liters and the over head tank (synthetic tank) will hold 5,000 liters.

5.8.5.8 Security room and electronic weigh bridge

An electronic weigh bridge of 30 tons capacity is proposed and the same room would also be a security room.

5.8.5.9 Store room

A store room (go-down) is also provided to store minimum stocks of finished products in the form of bag or bulk.

5.8.5.10 Machinery shed

This shed is for storing accessories, various parts of the machineries, processing equipments, oil & lubricants etc.

5.8.5.11 DG set

A 50 KV DG set is proposed as an alternative power.

5.8.5.12 High roof shed

This shed should accommodate processing machinery apart from providing shelter to the finished product in an area of 200 sq.mts and coarse compost (semi processed) in an area of 800 sq.mts. Most of the composting industries are not able to process waste during rainy season as the activity will be in an open area. In the instant case, provision is made to process the waste even during rainy season as 8 to 10 days material will be protected from rain water.

5.8.5.13 Barbed wire fencing

The compound wall is necessary for a secured composting activity. As the composting and landfill activity will take place some where in the middle of this area) however, barbed wire fencing is provided taking the amount required as lumpsum.

5.8.5.14 Laminated breathable non-oven HDPE sheets

These sheets are necessary in order to prevent the coarse compost becoming wet. If the course compost becomes wet, the storm discharge gets contaminated polluting the near by water bodies. These sheets are also helpful for continuing the processing activity/production even during rainy season.

5.8.5.15 Power supply

A total power supply of 125 HP is necessary to take care of composting activity including lighting in the composting area. A transformer with polls and sodium light is also found to be necessary in order to help continuous supply of power.

5.8.5.16 Processing machineries (mechanical)

The processing machinery is designed in such a way that the entire 375MT received in a day is processed in a single shift of 8 hours. Decomposing the waste for a period of 30 days and screening after 15 days to separate minute particles of glass, plastic, metals has been provided

The reject area and the course manure area set apart. The rejects from the 1st and 2nd screen are directed towards land fill site and the reject of 3rd and 4th screen is secured for use as pit fill manure and the cover material /absorbent.

5.8.5.17 Processing equipments

This is an area where the entire waste received is turned at regular intervals. Waste is shifted for feeding to the machinery. Rejects are pushed and the finished material is also moved to bagging area. The front end pay loaders are essential for above activities.

As there will be a lot of dust and moisture during waste treatment process, these equipments requires frequent and constant maintenance and there fore care is taken to provide adequate number of equipments including 10 wheel tippers for crisscross movement of waste / manure inside the treatment area and also to deliver finished material to the required place within the primary marketing zone.

Designing of the concrete yard, processing machineries and equipments have been done in order to ensure treatment of the waste on day to day basis. In a composting Industry waste should not be allowed to accumulate as it gives out pollution and the cost of holding will also be heavy.

5.8.6 Environmental impact assessment (EIA)

EIA is an important study to be carried out to assess environmental and ecological imbalances if any that has to be addressed in the implementation of the project. Though the project aims at mitigating the adverse impact of the indiscriminate and unscientific dumping of garbage, the process adopted will have to meet environmental standards. A safe and eco-friendly approach is therefore to be employed in the manufacture of organic manure and safe disposal of non-degradable rejects. Various other features are being adopted to see that the entire operation does not pose threat to the ecological balance of the surrounding area. The main environmental safeguards are planed in this project.

5.8.7 Estimated cost for the proposed compost plant/ In-vessel compost plant

Table 31: Production of Compost and its Profitability

1	Intake capacity of the project	375 TPD	136875 MT/Year
2	Processing Capacity of the Project	468.75 TPD	17093 MT/Year
3	Quantity of Manure Produced	180 TPD	66,000 MT/Year
4	Production Cost at Rs. 1500/- per MT	Rs. 2,70,000/day	Rs. 9,90,00,000.00/Year
5	Gross Sale Ex-plant at Rs. 1650/- per MT	Rs. 2,79,000/Day	Rs. 10, 89, 00,000.00/Year
6	Expected Profit		Rs. 99, 00,000.00/Year
	Rounded off		**Rs. 99 Lakhs/Year**

Table 32: Abstract Estimate for the Proposed 375 TPD Compost Plant

S.No	Items	Amount
Capacity Of The Plant 375 Tpd		
1	Concrete Yard	**23652431.00**
2	Laminated Breathable Non-Wooven Hdpe Sheets	**780000.00**
3	Leachate Tank	**225341.33**
4	Internal Roads & Peripheral Roads	**1685075.00**
5	Borewells	**899700.00**
6	Security Room & Weigh Bridge	**1342691.43**
7	Maintenance Shed	**94691.43**
8	D.G Room	**594691.33**
9	Electrical Poles With Sodium Lights & Transformer	**1550000.00**
10	Sump Tank (10000lts Capacity) And G.I Pipe Line	**140790.70**
11	Office Building & Lab	**1495886.66**
12	High Roof Shed	**25964883.08**
13	Store Room	**404948.62**
14	Leachate Treatment Facility (Ls)	**4000000.00**
15	Processing Machinery	**30000000.00**
16	Processing Equipments	**32000000.00**
17	Power Supply Of 125 Hp	**1600000.00**
18	Land Development	**1000000.00**
19	Rows Of Trees (Ls)	**500000.00**
20	Barbed Wire Fencing (Ls)	**1000000.00**
21	Furniture & Fittings For Office (Ls)	**400000.00**
22	Parking (Ls)	**350000.00**
23	Inventory (Ls)	**800000.00**
24	Miscellaneous	**100000.00**
	Total In Rs	**130581130.58**
	Rounded Off To	**130600000.00**

Table 33: Processing Machinery for Compost Plant

S.No	Specification	No	Amount	Total
1	A' Grade Rotary Screen	4	5000000	20000000.00
2	1 set of Rotary Screen of 25 mm dia	1	300000	300000.00
3	1 set of Rotary Screen of 10 mm dia	1	300000	300000.00
4	1 set of Rotary Screen of 4 mm dia	1	300000	300000.00
	Total			**20900000.00**

Table 34: Processing Equipments for Compost Plant

S.No	Specification	No	Amount	Total
1	Heavy duty pay loader	2	3000000	6000000.00
2	Hitachi 200	2	6000000	12000000.00
3	Medium duty pay loader	3	2000000	6000000.00
4	Tipper	4	1500000	6000000.00
5	Tractor	2	1000000	2000000.00
	Total			**32000000.00**

Table 35: BOQ For Concrete Yard For 375tpd (185m X175m)

S.No	Description of works	Unit	Nos	Lentgh	Breadth	Depth	Quantity	Rate	Amount
1	Excavation for foundation upto 1.5m depth including sorting out and stacking of useful materials and disposing excavated stuff upto 50m lead. For dense soil or hard								
	a) For fresh garbage yard	cum	1	250	65	0.45	7312.5		
	b)For drain	cum	1	250	1.7	0.7	297.5		
			1	65	1.7	0.7	77.35		
	c)For coarse material yard	cum	1	63	65	0.3	1228.50		
							8915.85	60	**534951.00**
2	Providing and laying **dry rubble packing** using hard stone rubble, handset one on edge, consolidating the same with power roller 8 to 10 tonnes wherever possible, or ramming with heavy wooden rammers, watering, filling, interstices with hand broken stone spalls and blinding the top with hard murum / stone dust at least 0.5 Cum per 10 Sq.m preliminary rolling / ramming of sub-grade watering, rolling and ramming etc. complete as directed by Engineer In-charge.								
	a) Fresh garbage yard	cum	1	250	65	0.15	2437.50		
	b) Coarse material yard	cum	1	63	65	0.15	614.25		
							3051.75	800	**2441400.00**
3	Filling in trenches or at any other place, spreading in layers of 150 mm thickness including watering, ramming and consolidating mechanically with 8-10 T power roller wherever possible or with mechanical rammers as per the specifications to the required line and level etc. complete with approved murrum brought from outside								
	a) Fresh garbage yard	cum	1	250	65	0.35	5687.50		
	b) Coarse material yard	cum	1	63	65	0.2	819.00		
							6506.50	200	**1301300.00**
4	Providing and laying of 1:4:8 cement concrete (1 part cement, 4part coarse sand, 8 part hand broken stone aggreate 40mm nominal								

	size) and curing complete excluding the cost of formwork in foundation and plinth.								
	a) Fresh garbage yard	cum	1	250	65	0.15	2437.5		
	b) Coarse material yard	cum	1	63	65	0.1	409.5		
							2847	1600	**4555200.00**
5	Providing and laying of 1:1.5:3 cement concrete (1 part of cement, 1.5part coarse sand, 3 part graded stone aaggreate 20mm nominal size) and curing complete excluding cost of form work and reinforcrmrnt, for reinforced concrete work in foundation, footing base of columns and mass concrete. expansion joints should be provided.								
	a) Fresh garbage yard	cum	1	250	65	0.15	2437.5		
	b) Coarse material yard	cum	1	63	65	0.1	409.5		
	d)For drain	cum	1	250	4.65	0.1	116.25		
			1	65	4.65	0.1	30.225		
							2993.48	2500	**7483687.50**
6	Providing mild steel reinforcement for RCC work	m.t					187	36500	**6825500.00**
7	Providing formwork of ordinary timber plankings so as to give a rough finsh including centering shuttering, strutting and prooping etc.								
	a) Fresh garbage yard	sqm	2	250		0.35	175		
			2	65		0.35	45.5		
	b) Coarse material yard	sqm	2	63		0.25	31.5		
			2	65		0.25	32.5		
	d)For drain	sqm	1	250		3.25	812.5		
			1	65		3.25	211.25		
							1308.25	250	**327062.50**
8	Smooth plastering for Drains using CM 1:4 finishing expose surface by cement slurry, curing,hacking etc,. Complete	sqm	1	250	4.85		1212.5		
			1	65	4.85		315.25		
							1527.75	120	**183330.00**
	TOTAL								**23652431.00**

						BREATHABLE SHEET			
1	**Breathable sheets.**	sqm	30	65	8		15600	50	**780000.00**

Table 36: BOQ For Security& Weigh Bridge Room

S.No	Description of Work	Unit	No	Length	Breadth	Depth	Qty	Rate	Amount
	SECURITY&WEIGH BRIDGE ROOM								
1	**Excavation** for foundations, walls, trenches, etc. including removal of vegetation, shrubs, debris, cutting & dressing of sides in slopes, pumping / bailing out water, shoring, strutting, under pinning, ramming and consolidating the bottom of excavated area, stacking the required quantity of selected excavated material for back-filling within project premises, back filling the excavated earth within the trenches, disposing the surplus excavated material complete **upto depths of 1.5m in all kinds of soil.**	Cum							
	a)long wall		2	4.1	0.9	0.9	6.642		
	b) short wall		2	2.4	0.9	0.9	3.888		
							10.53	60.00	**631.80**
2	Filling in plinth, trenches or at any other place, spreading in layers of 150 mm thickness including watering, ramming and consolidating mechanically with 8-10 T power roller wherever possible or with mechanical rammers as per the specifications to the required line and level etc. complete **with approved murrum brought from outside**	Cum							
			1	3	3	0.3	2.7	200.00	**540.00**
3	Providing and laying **Plain Cement Concrete** for all depths below and at all levels in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth as specified and directed all complete for concrete of nominal mix 1:4:8 by volume (1 Cement: 4 Coarse sand: 8 Crushed Stone Aggregates with 40 mm and down size graded crushed	Cum							

	stone aggregates.								
	a)long wall		2	4.1	0.9	0.1	0.738		
	b) short wall		2	2.4	0.9	0.1	0.432		
							1.17	1,600.00	**1872.00**
4	Providing and constructing **random rubble masonry** of thickness as specified at all levels in CM 1:6 mix in compound walls, trench walls, foundation walls, including scaffolding, raking out joints, including laying of bond stones at every 1mt, curing etc., complete at all elevations & heights as per drawing and specifications and as directed by Engineer In charge.	Cum							
	a)long wall		2	4.1	0.6	1.1	5.412		
	b) short wall		2	2.4	0.6	1.1	3.168		
							8.58	1,800.00	**15444.00**
5	Providing and laying **damp proof course** over brick walls/concrete block walls comprising of 50mm thick (1:2:4) mix cement concrete mixed with approved water proofing powder (1 kg. per 50 kg. of cement or as per manufacturers recommendations), curing etc., complete.	cum							
			2	6.5	0.6	0.075	0.585	2,200.00	**1287.00**
6	Providing and constructing 200 mm thick (nominal dimension) precast **solid concrete block** masonry in cement mortar 1:6 using cement concrete blocks of approved mix design and having minimum crushing strength of 5.00N/sqm conforming to IS: 2185 (Part-I) at all levels in superstructures and foundations including and in any shape for walls, trenches, pillars etc including providing recesses, opening, scaffolding, racking out of joints, curing etc., complete at all elevations & heights as per drawing and specifications.	sqm							
	a)long wall		2	3.4		3	20.4		
	b) short wall		2	3		3	18		
							38.4		
	Deduction								
	a) main door		1	1.2		2.1	2.52		
	c) Windows		2	1.35		1.35	3.645		
							6.165		
							32.24	450.00	**14505.75**

7	Providing and casting controlled C.C. M-200 and curing complete, excluding the cost of reinforcement, but including the cost for Form work (Scaffolding) for RCC work, for all floors, at all heights and levels, in any position, for all structures.	cum							
	a) Lintel		1	1.8	0.2	0.2	0.072		
			2	2	0.2	0.2	0.16		
	b) Mould (4.5" thick)		1	3.4	3.4	0.115	1.329		
							1.561	4,000.00	**6245.60**
8	Providing and applying 20 to 25 mm thick external sand faced & internal lime rendering waterproof cement **plaster** in 1:6 cement mortar on masonry / concrete wall surfaces including using best quality locally available sand in two coats keeping the surface of the base coat rough to receive sand\lime faced treatment, finishing the surface by taking out grains including mixing water proofing material in proportion recommended by the manufacturer, curing, scaffolding including providing the necessary grooves, drip moulds, vatas, etc. complete	sqm					64.47	130.00	**8381.10**
9	Providing and **Painting** for walls both internal as well as external with Approved quality approved branded Cement based paint over one coat of Primer and two coats of Cement based paint including clearing the surface by scrapping, and Removing the lumps of cement, curing etc., complete.	sqm					64.47	75.00	**4835.25**
10	Supplying and fixing **MS window/ ventilators** Using standered z angle frame with 10mm square ms rods as guard bars at 4"c/c including standered z angle shutter with hinges, fitted with 4mm glass fixing and enamel painting three coats over one coat of primer after preparing the surface by cleaning, sand papering, etc.,	sqm					3.645	650.00	**2369.25**
11	Providing and laying **Plain Cement Concrete** of nominal mix (1:4:8) of 100mm compacted thickness for all depths below and up to plinth level in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and **finishing the top surface** rough or smooth Using CM(1:6) Ponding the water for curing as specified and directed by Engineer In charge all complete,	sqm	1	3	3		9	250.00	**2250.00**

12	Providing & Fixing 35mm thk Normal **Solid Flush Door** with one coat of primer & 3 coats of synthetic enamel paint suitable for fitting into the existing door frames & 8mm thick glass cutout as per detail. All margins to be finished with TW lipping & painted . Cost to incl. Godrej make door handle type locks (concealed type), 230mm long 1 no tower bolt, 4 nos of hinges , Everite make door closer as per requirement.(Appox. size of 2m X 1m, actual size to be seen by the Bidder at site.)	sqm	1	1.2		2.1	2.52	2,500.00	**6300.00**
13	Providing, cutting, straightning, bending, shifting, placing **HYSD/TMT** reinforcement of Fe415 grade confirming IS 1786 standards for RCC works, using Binding wire etc. complete, at levels and in all floors.	**mt**							
	a)lintel						0.058		
	b)slabs beams						0.332		
							0.39	36,500.00	**14247.78**
14	Supply and fixing of PVC tank of standared quality	Ltr					10000	4.00	**40000.00**
15	Way bridge of 30t capacity	L/S							**1000000.00**
	TOTAL COST FOR CIVIL WORKS								**1118909.53**
	TOTAL COST FOR ELECTRICAL WORKS (10% OF CIVIL WORK COST)								**111890.95**
	TOTAL COST FOR SANITARY AND PLUMBING (10% OF CIVIL WORK COST)								**111890.95**
	GRAND TOTAL								**1342691.43**

Table 37: BOQ For Maintenance Shed

SL.no	Description of Work	Unit	No	Length	Breadth	Depth	Qty	Rate	Amount
	MAINTENANCE SHED								
1	**Excavation** for foundations, walls, trenches, etc. including removal of vegetation, shrubs, debris, cutting & dressing of sides in slopes, pumping / bailing out water, shoring, strutting, under pinning, ramming and consolidating the bottom of excavated area, stacking the required quantity of selected excavated material for back-filling within project premises, back filling the excavated earth within the trenches, disposing the surplus excavated material complete **upto depths of 1.5m in all kinds of soil.**	Cum							
	a)long wall		2	4.1	0.9	0.9	6.642		
	b) short wall		2	2.4	0.9	0.9	3.888		
							10.53	60.00	**631.80**
2	Filling in plinth, trenches or at any other place, spreading in layers of 150 mm thickness including watering, ramming and consolidating mechanically with 8-10 T power roller wherever possible or with mechanical rammers as per the specifications to the required line and level etc. complete **with approved murrum brought from outside**	Cum	1	3	3	0.3	2.7	200.00	**540.00**
3	Providing and laying **Plain Cement Concrete** for all depths below and at all levels in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth as specified and directed all complete for concrete of nominal mix 1:4:8 by volume (1 Cement: 4 Coarse sand: 8 Crushed Stone Aggregates with 40 mm and down size graded crushed stone aggregates.	Cum							
	a)long wall		2	4.1	0.9	0.1	0.738		
	b) short wall		2	2.4	0.9	0.1	0.432		
							1.17	1,600.00	**1872.00**
4	Providing and constructing **random rubble masonry** of thickness as specified at all levels in CM 1:6 mix in compound walls, trench walls, foundation walls, including scaffolding, raking out joints, including laying of bond stones at every 1mt, curing etc., complete at all elevations & heights as per drawing and specifications and as directed by Engineer In charge.	Cum							

	a)long wall		2	4.1	0.6	1.1	5.412		
	b) short wall		2	2.4	0.6	1.1	3.168		
							8.58	1,800.00	**15444.00**
5	Providing and laying **damp proof course** over brick walls/concrete block walls comprising of 50mm thick (1:2:4) mix cement concrete mixed with approved water proofing powder (1 kg. per 50 kg. of cement or as per manufacturers recommendations), curing etc., complete.	cum	2	6.5	0.6	0.075	0.585	2,200.00	**1287.00**
6	Providing and constructing 200 mm thick (nominal dimension) precast **solid concrete block** masonry in cement mortar 1:6 using cement concrete blocks of approved mix design and having minimum crushing strength of 5.00N/sqm conforming to IS: 2185 (Part-I) at all levels in superstructures and foundations including and in any shape for walls, trenches, pillars etc including providing recesses, opening, scaffolding, racking out of joints, curing etc., complete at all elevations & heights as per drawing and specifications.	sqm							
	a)long wall		2	3.4		3	20.4		
	b) short wall		2	3		3	18		
							38.4		
	Deduction								
	a) main door		1	1.2		2.1	2.52		
	c) Windows		2	1.35		1.35	3.645		
							6.165		
							32.24	450.00	**14505.75**
7	Providing and casting controlled C.C. M-200 and curing complete, excluding the cost of reinforcement, but including the cost for Form work (Scaffolidng) for RCC work, for all floors, at all heights and levels, in any position, for all structures.	cum							
	a) Lintel		1	1.8	0.2	0.2	0.072		
			2	2	0.2	0.2	0.16		
	b) Mould (4.5" thick)		1	3.4	3.4	0.115	1.329		
							1.561	4,000.00	**6245.60**

8	Providing and applying 20 to 25 mm thick external sand faced & internal lime rendering waterproof cement **plaster** in 1:6 cement mortar on masonry / concrete wall surfaces including using best quality locally available sand in two coats keeping the surface of the base coat rough to receive sand\lime faced treatment, finishing the surface by taking out grains including mixing water proofing material in proportion recommended by the manufacturer, curing, scaffolding including providing the necessary grooves, drip moulds, vatas, etc. complete	sqm					64.47	130.00	**8381.10**
9	Providing and **Painting** for walls both internal as well as external with Approved quality approved branded Cement based paint over one coat of Primer and two coats of Cement based paint including clearing the surface by scrapping, and Removing the lumps of cement, curing etc., complete.	sqm					64.47	75.00	**4835.25**
10	Supplying and fixing **MS window/ ventilators** Using standered z angle frame with 10mm square ms rods as guard bars at 4"c/c including standered z angle shutter with hinges, fitted with 4mm glass fixing and enamel painting three coats over one coat of primer after preparing the surface by cleaning, sand papering, etc.,	sqm					3.645	650.00	**2369.25**
11	Providing and laying **Plain Cement Concrete** of nominal mix (1:4:8) of 100mm compacted thickness for all depths below and up to plinth level in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and **finishing the top surface** rough or smooth Using CM(1:6) Ponding the water for curing as specified and directed by Engineer In charge all complete,	sqm	1	3	3		9	250.00	**2250.00**
12	Providing & Fixing 35mm thk Normal **Solid Flush Door** with one coat of primer & 3 coats of synthetic enamel paint suitable for fitting into the existing door frames & 8mm thick glass cutout as per detail. All margins to be finished with TW lipping & painted . Cost to incl. Godrej make door handle type locks (concealed type), 230mm long 1 no tower bolt, 4 nos of hinges , Everite make door closer as per requirement.(Appox. size of 2m X 1m, actual size to be seen by the Bidder at site.)	sqm	1	1.2		2.1	2.52	2,500.00	**6300.00**
13	Providing, cutting, straightning, bending, shifting, placing **HYSD/TMT** reinforcement of Fe415 grade confirming IS 1786 standards for RCC works, using Binding wire etc. complete, at levels and in all floors.	**mt**							

	a)lintel					0.058		
	b)slabs beams					0.332		
						0.39	36,500.00	**14247.78**
	TOTAL COST FOR CIVIL WORKS							**78909.53**
	TOTAL COST FOR ELECTRICAL WORKS (10% OF CIVIL WORK COST)							**7890.95**
	TOTAL COST FOR SANITARY AND PLUMBING (10% OF CIVIL WORK COST)							**7890.95**
	GRAND TOTAL							**94691.43**

Table 38: BOQ For D G Room

SL.no	Description of Work	Unit	No	Length	Breadth	Depth	Qty	Rate	Amount
	D.G. ROOM								
1	**Excavation** for foundations, walls, trenches, etc. including removal of vegetation, shrubs, debris, cutting & dressing of sides in slopes, pumping / bailing out water, shoring, strutting, under pinning, ramming and consolidating the bottom of excavated area, stacking the required quantity of selected excavated material for back-filling within project premises, back filling the excavated earth within the trenches, disposing the surplus excavated material complete **upto depths of 1.5m in all kinds of soil.**	Cum							
	a)long wall		2	4.1	0.9	0.9	6.642		
	b) short wall		2	2.4	0.9	0.9	3.888		
							10.53	60.00	**631.80**
2	Filling in plinth, trenches or at any other place, spreading in layers of 150 mm thickness including watering, ramming and consolidating mechanically with 8-10 T power roller wherever possible or with mechanical rammers as per the specifications to the required line and level etc. complete **with**	Cum	1	3	3	0.3	2.7	200.00	**540.00**

	approved murrum brought from outside								
3	Providing and laying **Plain Cement Concrete** for all depths below and at all levels in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth as specified and directed all complete for concrete of nominal mix 1:4:8 by volume (1 Cement: 4 Coarse sand: 8 Crushed Stone Aggregates with 40 mm and down size graded crushed stone aggregates.	Cum							
	a)long wall		2	4.1	0.9	0.1	0.738		
	b) short wall		2	2.4	0.9	0.1	0.432		
							1.17	1,600.00	**1872.00**
4	Providing and constructing **random rubble masonry** of thickness as specified at all levels in CM 1:6 mix in compound walls, trench walls, foundation walls, including scaffolding, raking out joints, including laying of bond stones at every 1mt, curing etc., complete at all elevations & heights as per drawing and specifications and as directed by Engineer In charge.	Cum							
	a)long wall		2	4.1	0.6	1.1	5.412		
	b) short wall		2	2.4	0.6	1.1	3.168		
							8.58	1,800.00	**15444.00**
5	Providing and laying **damp proof course** over brick walls/concrete block walls comprising of 50mm thick (1:2:4) mix cement concrete mixed with approved water proofing powder (1 kg. per 50 kg. of cement or as per manufacturers recommendations), curing etc., complete.	cum							
			2	6.5	0.6	0.075	0.585	2,200.00	**1287.00**
6	Providing and constructing 200 mm thick (nominal dimension) precast **solid concrete block** masonry in cement mortar 1:6 using cement concrete blocks of approved mix design and having minimum crushing strength of 5.00N/sqm conforming to IS: 2185 (Part-I) at all levels in superstructures and foundations including and in any shape for walls, trenches, pillars etc including providing recesses, opening, scaffolding, racking out of joints, curing etc., complete at all elevations & heights as per drawing and specifications.	sqm							
	a)long wall		2	3.4		3	20.4		

	b) short wall		2	3		3	18		
							38.4		
	Deduction								
	a) main door		1	1.2		2.1	2.52		
	c) Windows		2	1.35		1.35	3.645		
							6.165		
							32.24	450.00	**14505.75**
7	Providing and casting controlled C.C. M-200 and curing complete, excluding the cost of reinforcement, but including the cost for Form work (Scaffolidng) for RCC work, for all floors, at all heights and levels, in any position, for all structures.	cum							
	a) Lintel		1	1.8	0.2	0.2	0.072		
			2	2	0.2	0.2	0.16		
	b) Mould (4.5" thick)		1	3.4	3.4	0.115	1.329		
							1.561	4,000.00	**6245.60**
8	Providing and applying 20 to 25 mm thick external sand faced & internal lime rendering waterproof cement **plaster** in 1:6 cement mortar on masonry / concrete wall surfaces including using best quality locally available sand in two coats keeping the surface of the base coat rough to receive sand\lime faced treatment, finishing the surface by taking out grains including mixing water proofing material in proportion recommended by the manufacturer, curing, scaffolding including providing the necessary grooves, drip moulds, vatas, etc. complete	sqm					64.47	130.00	**8381.10**
9	Providing and **Painting** for walls both internal as well as external with Approved quality approved branded Cement based paint over one coat of Primer and two coats of Cement based paint including clearing the surface by scrapping, and Removing the lumps of cement, curing etc., complete.	sqm					64.47	75.00	**4835.25**
10	Supplying and fixing **MS window/ ventilators** Using standered z angle frame with 10mm square ms rods as guard bars at 4"c/c including standered z angle shutter with hinges, fitted with 4mm glass fixing and enamel painting three coats over one coat of primer after preparing the surface by cleaning, sand papering, etc.,	sqm					3.645	650.00	**2369.25**

11	Providing and laying **Plain Cement Concrete** of nominal mix (1:4:8) of 100mm compacted thickness for all depths below and up to plinth level in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and **finishing the top surface** rough or smooth Using CM(1:6) Ponding the water for curing as specified and directed by Engineer In charge all complete,	sqm	1	3	3		9	250.00	**2250.00**
12	Providing & Fixing 35mm thk Normal **Solid Flush Door** with one coat of primer & 3 coats of synthetic enamel paint suitable for fitting into the existing door frames & 8mm thick glass cutout as per detail. All margins to be finished with TW lipping & painted . Cost to incl. Godrej make door handle type locks (concealed type), 230mm long 1 no tower bolt, 4 nos of hinges , Everite make door closer as per requirement.(Appox. size of 2m X 1m, actual size to be seen by the Bidder at site.)	sqm	1	1.2		2.1	2.52	2,500.00	**6300.00**
13	Providing, cutting, straightning, bending, shifting, placing **HYSD/TMT** reinforcement of Fe415 grade confirming IS 1786 standards for RCC works, using Binding wire etc. complete, at levels and in all floors.	**mt**							
	a)lintel						0.058		
	b)slabs&beams						0.332		
							0.39	36,500.00	**14247.78**
15	D.G of capacity (50 KV)	L/S							**500000.00**
	TOTAL COST FOR CIVIL WORKS								**578909.53**
	TOTAL COST FOR ELECTRICAL WORKS (10% OF CIVIL WORK COST)								**7890.90**
	TOTAL COST FOR SANITARY AND PLUMBING (10% OF CIVIL WORK COST)								**7890.90**
	GRAND TOTAL								**594691.33**

Table 39: Providing Electrical Poles with Sodium Light Fixtures for Compost Plant Varanasi.

SL NO.	DESCRIPTION	UNIT	QTY	RATE	AMOUNT
1	Supply and erection of MS tubular pole 10. 5mtrs long using size of 5"x4"X3" dia.length of 6x2.75x1.75mtrs and thickness of 3.65x3.25x3.25mm respectively. The base plate should be 300x300x6mm and 1 mtr long single arm bracket using 5Omm dia. Gl pipe - moun ting lurninaire 8"X10" MS junction box for cable loopin and looput. Providing 2 length.s of 1m tr. long 50mm dia. 'B' Class Gl pipe for cable protection. The foundation should be provided with the combination of 1: 3 : 6 cement concrete size of O.6xO.6x 1.8mtrs. long Below the ground level and O. 5xO. 5x 1mtrs. long above the ground level. The pole shall be painted with 2 coats of aluminum paint etc., complete.	Each			
2	Supply, erection testing and commissioning of feeder pillar box (out door type) using 14 SWG sheet steel. The feeder pillar should be weather and vermin proof. The FPB should have double door. The FPB comprising of 3 Nos. 100 A TPN MCB 3 Nos. ML-2 contactor 1 No. twin dial auto ON/OFF timer switch terminal block internal wiring for automatic these components should be mounted on 6mm thick hylem sheet and 1 No. toggle swtich. The FPB should have pad-locking arrangement. The FPB should be mounted the four leged iron angle frame of size 40x40x6mm and length of 900mm. This should be grounded O. 6m tr. above the ground level with masonry work ground level with masonry around the platform. The EPB should be painted with 2 coats of red oxide and 2 coats of light grey paint inside and outside etc., complete.	Each			
3	Supply and erection of 250 w high pressure sodium Vapour lamp street light luminaire with one number 250 w HPSW lamp.	Each			
4	Supply and laying of 2 runs of 3/20 PVC insulated copper wires from junction box to luminaries.	Set			
5	Supply and laying of 40c x 16sqmm PVC insulated armoured underground cable the work includes excavation of trench size of 300mmx600mm depth in normal 1 size and back filling the same with sand, brick protection.	Rmt			

6	Supply and laying of 342 x 35sq mm PVC insulated armoured underground cable. The work include excavation of trench of size 300 w x 600 D in normal sizes and back filling the same with sand and brick protection	Rmt				
7	Supply and errection of cable glands Socket and 30A connector for 4Cx16 and 3 1/2C x 95sqmm cable.	Rmt				
8	Supply and laying of 100 mm Stoneware pipe for road crossing	Rmt				
9	Supply & laying of 50mm dia. 'B'Class GI pipe for cable protection.	Rmt				
10	Supplying and erection of pipe type earth station using 2. 5mtrs long 5 0mm dia. GI pipe watering funnel CI frame CI covers salt charcoal etc.,	Each				
11	Supply and laying of 25x3mm GI flat for earth continuity.	Rmt				
12	Supply and laying 0 f 8SWG WIRE for earth continuity.	Rmt				
13	Supplying & fixing of pot head suit for 3l/2x25sqmm UG Cable.	Each				
14	Supplying and fixing of 100 fuse cut outs for service mains	Each				
	TOTAL	Each	80	**12500.00**		**1000000.00**
	Transformer					
15	Providing and fixing Transformer with necessary accessories and platform along with meter cubicle	Each				**350000.00**
16	Providing & fixing panel board made of G.I sheets along with incoming and outgoing MCB's and all accessories	Each				**150000.00**
	Miscellaneous & Unforeseen charges					**50000.00**
			Total in Rs			**1550000.00**

Table 40: BOQ For SUMP TANK 10000 LTR CAPCITY

Sl.No.	Description of works	Unit	Nos	Lentgh	Breadth	Depth	Quantity	Rate	Amount
1	Excavation for foundation upto 1.5m depth including sorting out and stacking of useful materials and disposing excavated stuff upto 50m lead. For dense soil or hard soil	cum	1	3	3	2.2	19.8	60	1188.00
2	Providing and laying of 1:4:8 cement concrete (1 part cement, 4part coarse sand, 8 part hand broken stone aggreate 40mm nominal size) and curing complete excluding the cost of formwork in foundation and plinth.	cum	1	3	3	0.1	0.90	1600	1440.00
3	Providing and laying of 1:1.5:3 cement concrete (1 part of cement, 1.5part coarse sand, 3 part graded stone aaggreate 20mm nominal size) and curing complete excluding cost of form work and reinforcrmrnt, for reinforced concrete work in foundation, footing base of columns and mass concrete.	cum	2	2.8	2.8	0.1	1.57		
			2	2.65	0.15	2	1.59		
			2	2.65	0.15	2	1.59		
							4.748	2500	11870.00
4	Providing mild steel reinforcement fpr RCC work	mt					0.4748	36500	17330.20
5	Providing formwork of ordinary timber plankings so as to give a rough finsh including centering shuttering, strutting and prooping etc.	sqm	1	10		2	20		
			1	2.5		2.5	6.25		
							26.25	250	6562.50
7	Smooth plastering for Drains using CM 1:4 finishing expose surface by cement slurry, curing,hacking etc,. Complete	sqm	1	10		2	20	120	2400.00
8	For GI pipe and accessories	L/S							100000.00
	TOTAL								**140790.70**

Table 41: BOQ For Office Room

S.No	Description of Work	Unit	No	Length	Breadth	Depth	Qty	Rate	Amount
	OFFICE ROOM								
1	**Excavation** for foundations, walls, trenches, etc. including removal of vegetation, shrubs, debris, cutting & dressing of sides in slopes, pumping / bailing out water, shoring, strutting, under pinning, ramming and consolidating the bottom of excavated area, stacking the required quantity of selected excavated material for back-filling within project premises, back filling the excavated earth within the trenches, disposing the surplus excavated material complete **upto depths of 1.5m in all kinds of soil.**	Cum							
	a)long wall		2	21.3	0.9	0.9	34.506		
			2	10	0.9	0.9	16.2		
	b) short wall		4	7.5	0.9	0.9	24.3		
			7	1.6	0.9	0.9	9.072		
							84.078	60.00	**5044.68**
2	Filling in plinth, trenches or at any other place, spreading in layers of 150 mm thickness including watering, ramming and consolidating mechanically with 8-10 T power roller wherever possible or with mechanical rammers as per the specifications to the required line and level etc. complete **with approved murrum brought from outside**	Cum	1	21	10	0.3	63	200.00	**12600.00**
3	Providing and laying Plain Cement Concrete for all depths below and at all levels in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth as specified and directed all complete for concrete of nominal mix 1:4:8 by volume (1 Cement: 4 Coarse sand: 8 Crushed Stone Aggregates with 40 mm and down size graded crushed stone aggregates.	Cum							
	a)long wall		2	21.3	0.9	0.1	3.834		
			2	10	0.9	0.1	1.8		
	b) short wall		4	7.5	0.9	0.1	2.7		
			7	1.6	0.9	0.1	1.008		
							9.342	1,600.00	**14947.20**

4	Providing and constructing **random rubble masonry** of thickness as specified at all levels in CM 1:6 mix in compound walls, trench walls, foundation walls, including scaffolding, raking out joints, including laying of bond stones at every 1mt, curing etc., complete at all elevations & heights as per drawing and specifications and as directed by Engineer In charge.	Cum							
	a)long wall		2	21.3	0.6	1.1	28.116		
			2	10	0.6	1.1	13.2		
	b) short wall		4	7.5	0.6	1.1	19.8		
			7	1.6	0.6	1.1	7.392		
							68.508	1,800.00	**123314.40**
5	Providing and laying damp proof course over brick walls/concrete block walls comprising of 50mm thick (1:2:4) mix cement concrete mixed with approved water proofing powder (1 kg. per 50 kg. of cement or as per manufacturers recommendations), curing etc., complete.	cum	1	103.8	0.6	0.075	4.671	2,200.00	**10276.20**
6	Providing and constructing 200 mm thick (nominal dimension) precast solid concrete block masonry in cement mortar 1:6 using cement concrete blocks of approved mix design and having minimum crushing strength of 5.00N/sqm conforming to IS: 2185 (Part-I) at all levels in superstructures and foundations including and in any shape for walls, trenches, pillars etc including providing recesses, opening, scaffolding, racking out of joints, curing etc., complete at all elevations & heights as per drawing and specifications.	sqm							
	a)long wall		2	21		3	126		
			1	10		3	30		
	b) short wall		4	8		3	96		
			10	2.5		3	75		
							327		
	Deduction								
	a) main door		3	1.2		2.1	7.56		
	b) Toilet door		4	0.9		2.1	7.56		
	c) Windows		10	1.35		1.35	18.225		
	d) Ventilators		10	0.6		0.45	2.7		
							36.045		
							290.955	450.00	**130929.75**

7	Providing and casting controlled C.C. M-200 and curing complete, excluding the cost of reinforcement, but including the cost for Form work (Scaffolidng) for RCC work, for all floors, at all heights and levels, in any position, for all structures.	cum							
	a) Lintel		13	1.7	0.2	0.2	0.884		
			4	1.5	0.2	0.2	0.24		
			5	1.3	0.2	0.2	0.26		
			10	1	0.2	0.2	0.4		
	b)Beam		1	21	0.2	0.45	1.89		
			2	8.4	0.2	0.45	1.512		
	b) Mould (4.5" thick)		1	21	8.4	0.115	20.286		
			5	2.65	2	0.115	3.0475		
							28.5195	4,000.00	**114078.00**
8	Providing and applying 20 to 25 mm thick external sand faced & internal lime rendering waterproof cement plaster in 1:6 cement mortar on masonry / concrete wall surfaces including using best quality locally available sand in two coats keeping the surface of the base coat rough to receive sand\lime faced treatment, finishing the surface by taking out grains including mixing water proofing material in proportion recommended by the manufacturer, curing, scaffolding including providing the necessary grooves, drip moulds, vatas, etc. complete	sqm					581.91	130.00	**75648.30**
9	Providing and Painting for walls both internal as well as external with Approved quality approved branded Cement based paint over one coat of Primer and two coats of Cement based paint including clearing the surface by scrapping, and Removing the lumps of cement, curing etc., complete.	sqm					581.91	75.00	**43643.25**
10	Supplying and fixing MS window/ ventilators Using standered z angle frame with 10mm square ms rods as guard bars at 4"c/c including standered z angle shutter with hinges, fitted with 4mm glass fixing and enamel painting three coats over one coat of primer after preparing the surface by cleaning, sand papering, etc.,	sqm					20.925	650.00	**13601.25**

11	Providing and laying Plain Cement Concrete of nominal mix (1:4:8) of 100mm compacted thickness for all depths below and up to plinth level in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth Using CM(1:6) Ponding the water for curing as specified and directed by Engineer In charge all complete,	sqm	1	21	8		168		
			1	9	2.4		21.6		
							189.6	215.00	**40764.00**
12	Providing & Fixing 35mm thk Normal **Solid Flush Door** with one coat of primer & 3 coats of synthetic enamel paint suitable for fitting into the existing door frames & 8mm thick glass cutout as per detail. All margins to be finished with TW lipping & painted . Cost to incl. Godrej make door handle type locks (concealed type), 230mm long 1 no tower bolt, 4 nos of hinges , Everite make door closer as per requirement.(Appox. size of 2m X 1m, actual size to be seen by the Bidder at site.)	sqm	3	1.2		2.1	7.56	2,500.00	**18900.00**
13	Supplying and fixing hallow PVC doors of aprroved brand (Sintex or equvalent) with all fixtures like hinges, tower bolt, handles etc., complete.	sqm	5	0.75		2.1	7.875		
			4	0.9		2.1	7.56		
							15.435	1,850.00	**28554.75**
14	Providing and laying in position, glazed tiles of approved make and colour, of first quality as per design, set in cement slurry (3.3 kg. cement/m²) over a minimum 12 mm. thick cement mortar 1:3 bedding and laid to proper slope and level. Joints shall be filled with specified colour pigment, including curing, polishing and cleaning with mild oxalic acid etc. complete, as shown and specified, for flooring, dado or channel work etc. complete,	sqm	1	25		15	375	410.00	**153750.00**
15	Providing, cutting, straightning, bending, shifting, placing HYSD/TMT reinforcement of Fe415 grade confirming IS 1786 standards for RCC works, using Binding wire etc. complete, at levels and in all floors.	mt							
	a)lintel						0.446		
	b)slabs&beams						6.68388		
							7.12988	36,500.00	**260240.44**

Supplying and fixing anodised **Aluminium partition** at various elevations partly glazed, partly in MDF board minimum 45 mm thick panel with all necessary stiffeners, infill material, aluminium framework etc. including , rubber beading, clips as per Instructions of engineer In charge.	sqm	1	13		3	39	3,500.00	**136500.00**
Supplying, erecting including assembling and fixing **45 mm thick flush anodised Aluminium swing / sliding doors** at various elevations with frame, with or without louvers, neoprene rubber beading for air tightness, infill material, including vision panel, handles, fittings, fixtures, lock sets and all hardwares as a complete package. including glazing & rubber beading but including glazing clips, including floor springs or pivot / hinges with hydraulic door closer as necessary all complete as per specifications for different sizes of openings.	sqm	2	1.2		2.1	5.04	4,500.00	**22680.00**
Providing, supplying and installing **pre-approved 600mm x 600mm Prelaminated Gypsum false ceiling** using silhouette / fine line grid suspension system with black / white reveal to be installed as per design/detail/manufacturer's instalation specifications. The ceiling installation to be in line and level, as per design / details, with necessary cutouts as per dwgs and instructions. Rate to be inclusive of all accessories like wall angles, suspension system with leveling facility, and installed to the entire satisfaction of the supervising Engineer in Charge.	sqm	1	10		3	30	650.00	**19500.00**
Supply, **fabrication**, inspection , erection and painting with 2 coats of enamel paint including applying primer for Miscellaneous structural steel components viz trusses, ladders, gratings, platforms etc and any other similar items fabricated out of rolled sections and / or plates as per specifications and drawings including plant & machinery, tools & tackles etc. , including site welding whereever required, providing nuts & bolts, anchor fasteners as per specifications, complete as directed by Engineer (False ceiling supports)	mt					0.48	45,000.00	**21600.00**
TOTAL COST FOR CIVIL WORKS								**1246572.22**
TOTAL COST FOR ELECTRICAL WORKS (10% OF CIVIL WORK COST)								**124657.22**
TOTAL COST FOR SANITARY AND PLUMBING (10% OF CIVIL WORK COST)								**124657.22**
GRAND TOTAL								**1495886.66**

Table 42: BOQ For High Roof Shed

SL.no	Description of Work	Unit	No	Length	Breadth	Depth	Qty	Rate	Amount
	HIGH ROOF SHED								
1	**Excavation** for foundations, walls, trenches, etc. including removal of vegetation, shrubs, debris, cutting & dressing of sides in slopes, pumping / bailing out water, shoring, strutting, under pinning, ramming and consolidating the bottom of excavated area, stacking the required quantity of selected excavated material for back-filling within project premises, back filling the excavated earth within the trenches, disposing the surplus excavated material complete **upto depths of 1.5m in all kinds of soil.**	Cum	72	4.2	4.2	2.1	2667.168	60.00	**160030.08**
2	Filling in plinth, trenches or at any other place, spreading in layers of 150 mm thickness including watering, ramming and consolidating mechanically with 8-10 T power roller wherever possible or with mechanical rammers as per the specifications to the required line and level etc. complete **with approved murrum brought from outside**	Cum	72	4.2	4.2	1.3	1651.104	200.00	**330220.80**
3	Providing and laying Plain Cement Concrete for all depths below and at all levels in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth as specified and directed all complete for concrete of nominal mix 1:4:8 by volume (1 Cement: 4 Coarse sand: 8 Crushed Stone Aggregates with 40 mm and down size graded crushed stone aggregates.	Cum	72	4.2	4.2	0.15	190.512	1,600.00	**304819.20**
4	Providing and casting controlled C.C. M-200 and curing complete, excluding the cost of reinforcement, but including the cost for Form work (Scaffolidng) for RCC work, for all floors, at all heights and levels, in any position, for all structures.	cum							

	a)Footing		72	4	4	0.75	864		
	b)Pedestal		72	1.5	1.5	0.6	97.2		
	c)Column		72	1	1	10.45	752.4		
	d)Tie beam		12	65	0.3	0.75	175.5		
			12	65	0.3	0.75	175.5		
							2064.6	4,000.00	**8258400.00**
5	Providing and applying 20 to 25 mm thick external sand faced waterproof cement plaster in 1.5 cement mortar on masonry / concrete wall surfaces including using best quality locally available sand in two coats keeping the surface of the base coat rough to receive sand\lime faced treatment, finishing the surface by taking out grains including mixing water proofing material in proportion recommended by the manufacturer, curing, scaffolding including providing the necessary grooves, drip moulds, vatas, etc. complete	sqm							
	a)Column		72	4		10	2880		
	b)Beams		12	59		2.1	1486.8		
			12	59		2.1	1486.8		
							5853.6	130.00	**760968.00**
6	Providing and Painting for walls both internal as well as external with Approved quality approved branded Cement based paint over one coat of Primer and two coats of Cement based paint including clearing the surface by scrapping, and Removing the lumps of cement, curing etc., complete.	sqm					5853.6	75.00	**439020.00**
7	Providing, cutting, straightning, bending, shifting, placing HYSD/TMT reinforcement of Fe415 grade confirming IS 1786 standards for RCC works, using Binding wire etc. complete, at levels and in all floors.	mt							
	a)Footing						43.2		
	b)Pedestal						14.58		

	c)Column						37.62		
	d)Tie beam						17.55		
							112.95	36,500.00	**4122675.00**
8	Providing and fixing corrugated asbestos ISI branded sheets , and for side coverings, fixed with galvanized iron 'J' or 'L' hook bolts and nuts, 8 mm. dia.., with bitumen and GI washers filled with white lead etc. complete, excluding the cost of purlins, rafters and trusses.	sqm	8	17.5	65		9100	350	**3185000.00**
9	Providing and fabricating truss, purlin, rafters as per design to support AC sheet which includes welding, grinding, bolts, riveting etc. Paintig of approved colour on a base coat of primer, scaffolding, errection to complete.	mt					227.5	36,500.00	**8303750.00**
	TOTAL COST FOR CIVIL WORKS								**25864883.08**
	TOTAL COST FOR ELECTRICAL WORKS .	LS							**100000.00**
	GRAND TOTAL								**25964883.08**

Table 43: BOQ For High Roof Shed

L.no	Description of Work	Unit	No	Length	Breadth	Depth	Qty	Rate	Amount
	STORE ROOM								
1	**Excavation** for foundations, walls, trenches, etc. including removal of vegetation, shrubs, debris, cutting & dressing of sides in slopes, pumping / bailing out water, shoring, strutting, under pinning, ramming and consolidating the bottom of excavated area, stacking the required quantity of selected excavated material for back-filling within project premises, back filling the excavated earth within the trenches, disposing the surplus excavated material complete **upto depths of 1.5m in all kinds of soil.**	Cum							

	a)long wall		2	10.3	0.9	0.9	16.686		
	b) short wall		2	7.3	0.9	0.9	11.826		
	c)footing		9	1.7	1.7	1.5	39.015		
							67.527	60.00	**4051.62**
2	Filling in plinth, trenches or at any other place, spreading in layers of 150 mm thickness including watering, ramming and consolidating mechanically with 8-10 T power roller wherever possible or with mechanical rammers as per the specifications to the required line and level etc. complete **with approved murrum brought from outside** footing	Cum							
			1	6	9	0.3	16.2		
			9	1.7	1.7	1	26.01	200.00	**8442.00**
3	Providing and laying Plain Cement Concrete for all depths below and at all levels in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth as specified and directed all complete for concrete of nominal mix 1:4:8 by volume (1 Cement: 4 Coarse sand: 8 Crushed Stone Aggregates with 40 mm and down size graded crushed stone aggregates.	Cum							
	a)long wall		2	10.3	0.9	0.1	1.854		
	b) short wall		2	7.3	0.9	0.1	1.314		
	c)footing		9	1.7	1.7	0.1	2.601		
							5.769	1,600.00	**9230.40**
4	Providing and constructing **random rubble masonry** of thickness as specified at all levels in CM 1:6 mix in compound walls, trench walls, foundation walls, including scaffolding, raking out joints, including laying of bond stones at every 1mt, curing etc., complete at all elevations & heights as per drawing and specifications and as directed by Engineer In charge.	Cum							
	a)long wall		2	10.3	0.6	0.4	4.944		
	b) short wall		2	7.3	0.6	0.4	3.504		

							8.448	1,800.00	**15206.40**
5	Providing and constructing 200 mm thick (nominal dimension) precast solid concrete block masonry in cement mortar 1:6 using cement concrete blocks of approved mix design and having minimum crushing strength of 5.00N/sqm conforming to IS: 2185 (Part-I) at all levels in superstructures and foundations including and in any shape for walls, trenches, pillars etc including providing recesses, opening, scaffolding, racking out of joints, curing etc., complete at all elevations & heights as per drawing and specifications.	sqm							
	a)long wall		2	10.3		4.5	92.7		
	b) short wall		2	7.3		4.5	65.7		
							158.4		
	Deduction								
	a) main door		2	1.2		2.1	5.04		
	c) Windows		4	1.35		1.35	7.29		
	d) Ventilators		8	0.6		0.45	2.16		
	c) column		9	0.45		0.2	0.81		
	e)lintel		6	2		0.2	2.4		
			8	1.3		0.2	2.08		
							19.78		
							138.62	450.00	**62379.00**
6	Providing and casting controlled C.C. M-200 and curing complete, excluding the cost of reinforcement, but including the cost for Form work (Scaffolidng) for RCC work, for all floors, at all heights and levels, in any position, for all structures.	cum							
	a) Lintel		6	2	0.2	0.2	0.48		
			8	1.3	0.2	0.2	0.416		

	b)Plinth beam		3	9.4	0.2	0.45	2.538		
			3	6.4	0.2	0.45	1.728		
	c) Mould (4.5" thick)		1	9.4	6.4	0.115	6.9184		
	d)Slab beam		3	9.4	0.2	0.335	1.8894		
			3	6.4	0.2	0.335	1.2864		
	e)Footing		9	1.5	1.5	0.3	6.075		
	f)Column		9	0.45	0.2	5	4.05		
							25.381	4,000.00	**101524.80**
7	Providing and applying 20 to 25 mm thick external sand faced & internal lime rendering waterproof cement plaster in 1:6 cement mortar on masonry / concrete wall surfaces including using best quality locally available sand in two coats keeping the surface of the base coat rough to receive sand\lime faced treatment, finishing the surface by taking out grains including mixing water proofing material in proportion recommended by the manufacturer, curing, scaffolding including providing the necessary grooves, drip moulds, vatas, etc. complete	sqm					160.8	130.00	**20904.00**
8	Providing and Painting for walls both internal as well as external with Approved quality approved branded Cement based paint over one coat of Primer and two coats of Cement based paint including clearing the surface by scrapping, and Removing the lumps of cement, curing etc., complete.	sqm					160.8	75.00	**12060.00**
9	Supplying and fixing MS window/ ventilators Using standered z angle frame with 10mm square ms rods as guard bars at 4"c/c including standered z angle shutter with hinges, fitted with 4mm glass fixing and enamel painting three coats over one coat of primer after preparing the surface by cleaning, sand papering, etc.,	sqm					9.45	650.00	**6142.50**
10	Providing and laying Plain Cement Concrete of nominal mix (1:4:8) of 100mm compacted thickness for all depths below and up to plinth level in foundations, fillings, non-suspended floors, pavements and ramps etc, including tamping, ramming vibrating, curing, shuttering etc. all as specified in any shape, position, thickness and finishing the top surface rough or smooth Using CM(1:6) Ponding the water for curing as specified and directed	sqm	1	6	9		54	250.00	**13500.00**

	by Engineer In charge all complete,								
11	Providing & Fixing 35mm thk Normal **Solid Flush Door** with one coat of primer & 3 coats of synthetic enamel paint suitable for fitting into the existing door frames & 8mm thick glass cutout as per detail. All margins to be finished with TW lipping & painted . Cost to incl. Godrej make door handle type locks (concealed type), 230mm long 1 no tower bolt, 4 nos of hinges , Everite make door closer as per requirement.(Appox. size of 2m X 1m, actual size to be seen by the Bidder at site.)	sqm	2	1.2		2.1	5.04	2,500.00	**12600.00**
12	Providing, cutting, straightning, bending, shifting, placing HYSD/TMT reinforcement of Fe415 grade confirming IS 1786 standards for RCC works, using Binding wire etc. complete, at levels and in all floors.	**mt**							
	a)Lintel						0.224		
	b)Plinth beam						1.0665		
	c)Column						1.0125		
	d)Footing						1.5188		
	e)Slab&beam						1.5188		
							2.5236	28,300.00	**71416.47**
	TOTAL COST FOR CIVIL WORKS								**337457.19**
	TOTAL COST FOR ELECTRICAL WORKS (10% OF CIVIL WORK COST)								**33745.72**
	TOTAL COST FOR SANITARY AND PLUMBING (10% OF CIVIL WORK COST)								**33745.72**
	GRAND TOTAL								**404948.62**

5.9 Disposal of waste

The MSWM rules 2000 mandate that each municipal authority shall set up an engineered landfill for disposal of waste. It directs as under.

Landfilling shall be restricted to non-biodegradable, inert wastes and other wastes those are not suitable either for recycling or for biological processing.

Land filling shall also be carried out for residues of waste processing facilities as well as pre-processing rejects from waste processing facilities. Landfilling of mixed waste shall be avoided unless the same is found unsuitable for waste processing. Under unavoidable circumstances or till installation of alternate facilities, land filling shall be done following proper norms. Landfill sites shall meet the specifications as given schedule III of the above rules.

5.9.1 Proposal for Landfill

The total waste generated in the city presently is 600 MT/day. Out of this the organic waste collected from the door step from the house holds, vegetable markets, hotels etc will be taken to the Processing site and inerts will be taken to the disposal site. After the composting process is over, the rejects will also be taken to the landfill. The inerts and rejects that are expected to reach the landfill are assumed at 40% of the total waste, which works out to 240 MT/day. There is a need to construct 7 landfill cells (3 year life each) to last for 20-25 years. The total area of land required for composting and Landfilling for 20-25 years would be about 225 acres. The Municipal Corporation therefore needs a site having an area of 250 acres or more.

This land requirement for the compost plant and landfill site is calculated keeping in mind the need of next 20 - 25 years with a provision of buffer area to minimize the NIMBY syndrome. However, the land available with the Municipal Corporation is only about 48.13 Acres so the requirement of land has been split in to two phases. Initially the compost plant is proposed to be constructed on 12 Acres of land and two cells for the landfill which will last for about 6 years are proposed to be constructed in phase 1 at the land available with the Municipal Corporation. The cost estimate is made accordingly for the construction of compost plant and two cells of the landfills. It is suggested that the Corporation, in the mean time, should look for suitable parcel of At least 125 Acres land for future which they may acquire or bring in private sector to construction and operate waste disposal facility on their own land on the concept of tipping fees. This DPR is now restricted to 48 Acres of land only for construction of treatment and disposal facility in Phase I.

The Corporation has offers from private sectors to take up the operation and maintenance of the compost plant as well as setting up of land fills on their own land which would be taken up by the Corporation in phase II as soon as the private sector comes up with concrete proposal before the Corporation.

It is proposed to construct two cells of landfills on the 48 acres of land available with the Municipal Corporation in phase one which will last for 6 years and go for 2nd phase of construction when VNN acquires additional land.

5.9.1.1 Strategy to Take Care of Open Dumps

All open dumps in the city have been differentiated under 3 categories as follows,

1. Private land dumping
2. Waste on which covering of 600 mm compacted soil to be done **(Alternative"A")**
3. Waste on which proper closure with bund on 3 or 4 sides to be done **(Alternative"B")**
4. Waste on the banks of river Ganga is transported within 5 km and capped with 600mm compacted soil. **(Alternative "C")**

Waste is being dumped on private lands. e.g all open dumps in Sigra ward are on private land. Few dmps in Nagwa ward, Jaitpura ward, Sicrol ward and Samath ward are also on private land. In some cases, the dumping has been done with the consent of the land owners. They will not allow the waste to be removed. Thus government can not be involved in handling of waste on such area. Hence dumps on all Private lands are left untouched. These dumps are 35 in number.

At some places in Aadampur, Sicrol ward and Sarnath ward, waste is being dumped having large dimensions. At such places alternative "A" is to be adapted. In this alternative the waste is to be given a proper slope of approximately 1V:2.5H. To achieve this slope, some amount of waste will have to be dozed in cut and fill to get the required stable slopes. After getting the required slope, this waste is to be covered using 600 mm compacted soil. The estimation for this alternative is attached separately. This type of temporary closure will help in minimizing the amount of leachate formed as soil layer will help to reduce the amount of water percolating the waste. Also it will help in improving aesthetic appearance and help in preventing the nuisance created by flies, animals and also bird menace. The total number of such dumps is 20 in number.

For remaining places in Nagva ward, Jaitpura, Adampur, Sicrol ward alternative "B" is adopted as most of the places are covered with large amount of waste along the small bridges. From these places, the waste is to be closed with proper closure method with geomembrane and provision for gas vents. At some places where the dumps are very small in size, the waste is to be hauled to the nearest larger open dump.

On the banks of the river Ganga, especially on Naya ghat, Pralhad ghat, Sakka ghat

and Telliyanala ghat waste is being dumped. This waste will have to be picked up manually into a truck and transported to a suitable site within 5 Km. This waste will be compacted and capped with 600mm thk soil thus reducing the site to only 1 in number. This is categorized as Alternative "C"

All the alternatives are proposed to eradicate the problem of open dumping in the city, thus keeping the city clean. This will minimize public nuisance, foul odor, animal and bird menace. It will also minimize the land and water pollution. All these alternatives are proposed for the waste dumps in the city.

All the alternatives are proposed to eradiate the problem of open dumping in the city, thus keeping the city clean. This will minimize public nuisance, foul odor, animal and bird menace. It will also minimize the land and water pollution. All these alternatives are proposed for the waste dumps in the city.

5.9.1.2 Treatment and Disposal of future waste

It is proposed that the waste generated will be collected systematically and transported to the processing and disposal site. The Collection and transportation has been separately considered in the DPR. The Processing of the waste has been considered by composting the organic matter. The rejects from the same would be taken to the landfill.

The Details about the Alternatives Proposed for Closure of Open Dumps is given below:

5.9.1.3 Alternative A

In some areas in city the waste is dumped to a large height with area covered away from the rivers. In such cases, lifting of waste would not be required. The heaps of waste would be dosed and compacted so as to have stable slopes. These would then be covered using 600mm thick compacted soil layer.

While covering the waste using 600mm thick compacted soil, 10% of total volume of each dumpsite is considered for cutting and leveling, to achieve the desired slope of 1V:2.5H. After cutting and leveling of waste, 600mm thick compacted soil is spread over it. The BOQ's for all the sites are attached separately.

5.9.1.4 Alternative B

In some areas of city, the waste is lying along the river ghats and between the bridges. In such areas heaps of waste will be given proper slope of 1V:2H, a concrete wall would be constructed surrounding the waste and the waste would be covered with proper closure system.

In areas like Jaitpura, near Nakki Ghat the waste having a total volume of 100 X 35 X

11 = 38500 M3 is dumped. This waste is lying on the banks of the Varuna River. A concrete wall would have to be constructed around the waste heap at the toe. The waste would be given proper slope and then covered using 200mm thick gravel layer on slope and 200mm thick gravel layer on top followed by 1mm thick H.D.P.E. liner, 350 gsm geotextile, 450mm thick compacted soil, finally followed by stone pitching.

This method of covering the waste is selected to ensure that the waste does not slip into the river when it is in spate during rains. The soil of the closure is covered with stone pitching.

In Sicrol Ward between two Varuna bridges, four heaps of wastes is lying and near Ahirana Varuna bridge, two heaps of wastes is lying. Here, two heaps of waste lying in between Varuna bridge have dimensions 15 X 5.5 X 6.0m and 5.5 X 5.0 X 6.0m, and both the heaps near Ahirana Varuna bridge have dimensions 9.5 X 2.5 X 1.125m and 6.0 X 5.0 X 1.2m are clubbed together and then closure is done. Other two heaps lying in between two Varuna bridges of dimensions 15 X 5.75 X 7.5m and 25 X 17 X 8.5m are closed separately and the waste heaps lying on both sides of Chokaghat bridge of dimensions 14 X 6 X 10m, 5 X 4 X 8m and 8 X 5 X 7m are also closed separately with proper closure system. The BOQ'S for all this work are attached.

5.9.1.5 Alternative C

In Adampur area, waste is lying on slopes along Ganga River. As this waste is on the slopes, it has to be removed from this place to stop it from slipping in the river. The leachate forming due to this waste is also flowing into the river, which is highly objectionable. There are 9 such locations which will be picked up and formed into 1 number.

The volume of waste on these four ghats is as follows:

Naya Ghat = 25 X 32 X 1.0 = 800 cum.

Pralhad Ghat = 27 X 18 X 1.0 = 486 cum.

Sakka Ghat = 27 X 28 X 1.0 = 756 cum.

= 16 X 30 X 1.0 = 480 cum.

Teliyanala Ghat = 16 X 40 X 1.0 = 640 cum.

= 30 X 50 X 1.0 = 1500 cum.

= 30 X 35 X 1.0 = 1050 cum.

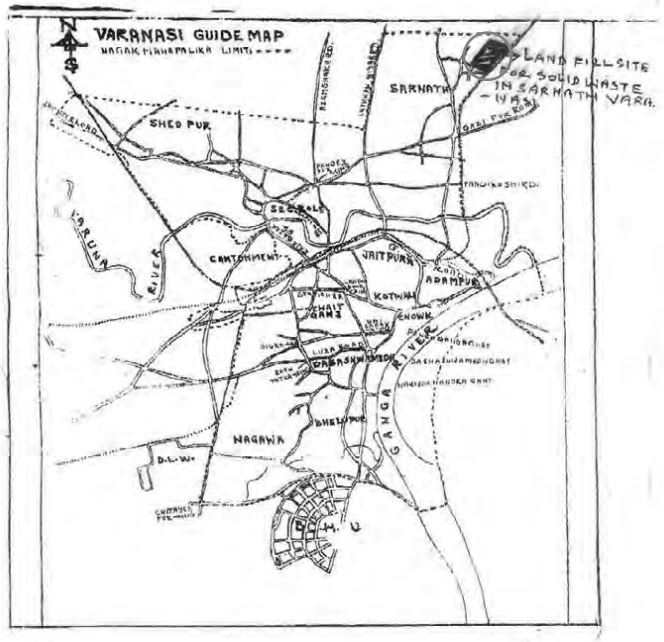
= 30 X 46 X 1.0 = 1380 cum.

Shailpuli Jharka Pokhri = 60 X 11 X 1.5 = 990 cum.

Total volume of waste is 8082 cum.

This waste will have to be lifted manually from the river basin into a truck waiting on top of the ghat. This truck will then transport the waste to a site within 5 Kms from the above locations. After the waste is transported, it is spread on land having dimensions 70 m X 70 m X 1.5 m and then covered with 600 mm compacted soils. The rate analysis for lifting of waste, transporting and spreading of soil is attached separately.

5.9.2 Site Characteristics & Its Implications On Landfill Design Facility:



Map showing location of Proposed Landfill

The NNV has a plot identified for waste treatment and disposal covering an area of 48.13 acres. This a small area compared to the land required for 25 years. It is therefore necessary for NNV to locate a plot of more than 125 acres in the next 2 years. The data will include meteorological data, ground water data, site plan, contour plan etc. The details about the baseline data are given below. The data collection for both plots i.e. 48.13 acres and the proposed 125 acres have been considered in the costing.

Table 44: Baseline data Collection

NAGAR NIGAM VARANASI					
A. Baseline data collection for proposed 48.13 acres of land					
No.	**Description**	**Qty**	**Unit**	**Rate**	**Amount**
1	Initial survey of villages	1	LS	10500	10500
2	Boreholes up to 10m depth	8	No.	21450	171600
3	Permeability test-1No./2 hectares SPT an collection of undisturbed samples, Soil Investigation - Classification, gradation Atterberg's limit, Bulk density, dry density, water content, cohesion, Angle of Internal friction, Proctor density, Optimum moisture content, coefficient of permeability, strength, compressibility	8	No.	9600	76800
4	Hydrogeological survey - ground water flow direction, gradient, bedrock profile, surface water & drainage, Aquifer attributes - depth, range, Average yield, transmissivity, storage coefficient. Geological report- Profile, rock depth, slope, subsidence	1	No.	35000	35000
5	Topographical survey - by Total Station method	48	Acres	1200	57600
6	Well Water Samples	2	No.	4600	9200
7	Surface Water Samples	1	No.	4600	4600
8	Ambient Air Quality	3	No.	4600	13800
NAGAR NIGAM VARANASI					
B. Baseline data collection for next 125 acres of land					
No.	**Description**	**Qty**	**Unit**	**Rate**	**Amount**
1	Initial survey of villages	1	LS	10500	10500
2	Boreholes up to 10m depth	15	No.	21450	321750
3	Permeability test-1No./2 hectares SPT an collection of undisturbed samples, Soil Investigation - Classification, gradation Atterberg's limit, Bulk density, dry density, water content, cohesion, Angle of Internal friction, Proctor density, Optimum moisture content, coefficient of permeability, strength, compressibility	15	No.	9600	144000
4	Hydrogeological survey - ground water flow direction, gradient, bedrock profile, surface water & drainage, Aquifer attributes - depth, range, Average yield, transmissivity, storage coefficient. Geological report- Profile, rock depth, slope, subsidence	1	No.	35000	35000
5	Topographical survey - by Total Station method	125	Acres	1200	150000
6	Well Water Samples	6	No.	4600	27600
7	Surface Water Samples	4	No.	4600	18400
8	Ambient Air Quality	4	No.	4600	18400

5.9.3 Landfill Design Facilities

The landfill design is based on geological and hydrogeological conditions, projected waste generation, and volume along with procedures to reduce potential impacts to the existing natural and social environment of the site.

The basic steps essential for the landfill designs are:

1. Landfill sizing
2. Site layout
3. Landfill layout
4. Leachate management
5. Landfill gas management

5.9.3.1 Landfill Sizing

The volume of waste to be landfilled is worked out for the active period of landfill taking into account (1) the current waste generation per annum and (2) the expected increase in waste generation rate based on population growth and influx of floating population due to the religious importance the city has over the years. The life of the landfill site proposed is supposed to be 25 years. The current waste generation rate is about 600 metric tonnes for 2007.

The sizing and designing of the landfill is based on the assumption that with the collection, transportation system in place the waste collection efficiency would improve to 100% in the 1st year. It is also assumed that the waste generation rate would increase by 5% per annum for 25 years period even though the population may rise at 1.5 - 2%. This is basically due to the change in life styles of the people.

Table 45: Estimated waste Quantity to be land filled

NAGAR NIGAM VARANASI							
Varanasi - Landfill Size estimation with starting point at 600 TPD in 2007 and 5% increase every year for 5.5 years							
Year	**Waste TPD**	**Landfill Cap (40%) TPD**	**Vol M3**	**Add Vol for soil 15%**	**Vol/yr M3**	**Phase Vol Reqd M3**	**Phase Vol Provided M3**
2007	600.00	240.00	300.00	345.00	125925		
2008	630.00	252.00	315.00	362.25	132221		
2009	661.50	264.60	330.75	380.36	138832	**396979**	**400000**
2010	694.58	277.83	347.29	399.38	145774		
2011	729.30	291.72	364.65	419.35	153063		
2012	765.77	306.31	382.88	440.32	160716	**459552**	**460000**
	Total					**856531**	**860000**

Varanasi - Landfill Size estimation with starting point at 600 TPD in 2007 and 5% increase every year for next 20 years							
Year	**Waste TPD**	**Landfill Cap (40%) TPD**	**Vol M3**	**Add Vol for soil 15%**	**Vol/yr M3**	**Phase Vol Reqd M3**	**Phase Vol Provided M3**
2013	804.06	321.62	402.03	462.33	168752		
2014	844.26	337.7	422.13	485.45	177189		
2015	886.47	354.59	443.24	509.72	186049	**531990**	**532000**
2016	930.8	372.32	465.4	535.21	195351		
2017	977.34	390.93	488.67	561.97	205119		
2018	1026.2	410.48	513.1	590.07	215374	**615844**	**620000**
2019	1077.51	431.01	538.76	619.57	226143		
2020	1131.39	452.56	565.69	650.55	237450		
2021	1187.96	475.18	593.98	683.08	249323	**712916**	**720000**
2022	1247.36	498.94	623.68	717.23	261789		
2023	1309.72	523.89	654.86	753.09	274878		
2024	1375.21	550.08	687.61	790.75	288622	**825289**	**830000**
2025	1443.97	577.59	721.99	830.28	303054		
2026	1516.17	606.47	758.09	871.8	318206		
2027	1591.98	636.79	795.99	915.39	334117	**955377**	**960000**
2028	1671.58	668.63	835.79	961.16	350823		
2029	1755.16	702.06	877.58	1009.22	368365		
2030	1842.92	737.17	921.46	1059.68	386783	**1105971**	**1110000**
2031	1935.06	774.02	967.53	1112.66	406121		
2032	2031.81	812.72	1015.91	1168.3	426430	**832551**	**833000**
	TOTAL					**5579938**	**5605000**

5.9.3.2 Site Layout

The infrastructure facilities to be provided at the proposed landfill site are as follows:

1. Approach roads
2. Weigh bridge
3. Temporary storage of waste, inspection
4. Administration building and laboratory
5. Garage and vehicle washing area
6. Site drainage facilities
7. Location of leachate collection facilities
8. Landfill gas collection/monitoring and management system
9. Monitoring network

All internal roads within the property leading to the landfill should be black top roads having a two-carriage width of 4 meters. One side of the road will have a 3m width for plantation. To ensure site safety and security, security cabin at the entrance should

be maintained. An administrative building will be provided for the landfill supervisors and clerical staff. Parking facility will be provided behind the administration building for cars and two wheelers. The weigh bridge facility with the adjacent room will be maintained to keep a record of the waste quantities entering the site. A temporary waste storage area for wastes which are not acceptable at the landfill will be provided with adjacent lorry parking facilities. A temporary waste storage facility and the adjoining parking lot with toilet facilities will be provided. A stockpile shed to store any landfill construction material is also provided. Landfill operations require the use of an excavator, compactor and a tractor, so a repair and maintenance shed for the same has been provided. The facility will have its own water supply and wastewater collection sump, which will be shared by the nearby tyre wash area. All waste carrying lorries exiting the premises should pass through a tyre wash area with all the necessary facilities in their last trip into the landfill. The facility is located on the exit way of the waste carrying trucks. The landfill will have a 1710 meter perimeter road all around.

5.9.3.3 Landfill Layout

The site identified by the NNV is small and will last for only 5.5 years. Identification of new land of more than 125 acres has been suggested to the NNV. This work should be completed in 2 years. A layout for the same is enclosed to make use of the land to its optimum use.

5.9.3.4 Leachate Management

A proper Leachate collection system will be provided to carry the Leachate into the Leachate collection tank. The leachate will travel through the gravel fill into the lateral pipes. These will carry the Leachate to the header pipes from where it will be taken to the tank.

5.9.3.5 7.5 Landfill Gas Management

The proposed system of Solid Waste Management at Varanasi will consist of segregation of waste at source, transporting the same to composting yards for processing. The organic waste would be converted into manure while the rejects would go to landfill. The recyclable material would be collected separately and given to the recycling route. The inert material collected at source mainly comprising of soil from road sweeping would come to landfill.

With the provision of composting, only inert material will be deposited in the landfill. Some quantity of rejects of large size organics from the compost plant will also get into the landfill. It is expected that not more than 5% of the waste in the landfill would be biodegradable. As the particle size of organic rejects of compost plant is large, its degradation will be very slow and will continue for a long time in the Dry Tomb

Landfill. It would thus be necessary to provide Passive gas vents instead of proper gas collection system. The design of passive vents for release of landfill gas has to be designed keeping this in mind.

5.9.4 Landfill Design Features and Site Plan

5.9.4.1 Landfill Design Features

The Landfill has been designed taking into consideration the MSW 2000 Rules. The NNV has a plot identified for waste treatment and disposal covering an area of 48.13 acres. This a small area compared to the land required for 25 years. It is therefore necessary for NNV to locate a plot of more than 125 acres in the next 2 years

The designed landfill cells along with composting plant have been spread over an area of 48 acres. It is suggested that the waste be deposited till a height of 10 m above the bund, with bench of 3m wide after every 5m of vertical height. The waste compaction is considered at 800 Kg/M3. The total volume of the landfill (phase 1 & 2) would be 8,60,000 M3 which would last for 5.5 years.

The landfills are operated in cells. This is primarily done to reduce the operating area so that the formation of Leachate is reduced. This helps in Leachate management. It is proposed that the landfill be constructed and operated in different cells. The capacity of each cell has been mentioned in the table below along with the capacity in years.

Table 46: Landfill phasing details

A. For the First 5.5 Years			
Cell	**Period**	**Vol. Provided (M3)**	**Life(Years)**
1	**2007-09**	**400000**	**2.5**
2	**2010-12**	**460000**	**3.0**
	Total	**8,60,000**	**5.5**
B. For the Next 20 Years			
1	**2013-15**	**532000**	**3**
2	**2016-18**	**620000**	**3**
3	**2019-21**	**720000**	**3**
4	**2022-24**	**830000**	**3**
5	**2025-27**	**960000**	**3**
6	**2028-30**	**1110000**	**3**
7	**2031-32**	**833000**	**2**
	Total	**56,05,000**	**20**

5.9.5 Landfill Construction

5.9.5.1 Landfill Base Liner Preparation

The base liner at the Varanasi landfill will be a composite liner comprising of 50 cm of native soil compacted to 95% Proctor density compaction overlaid with a Geosynthetic Clay Liner (GCL). A 1.5 mm HDPE geomembrane will be placed over the GCL. The leachate collection system will be placed over the geomembrane and comprises a 300 mm thick gravel layer, constituting smooth, round gravel, 12-25 mm in size. Perforated HDPE leachate collection pipes will be embedded in this gravel layer.

The following technical issues need to be addressed during the construction of landfill, which are given below

5.9.5.2 Raising of overall Base by Native Soil

The Landfill bottom has been made inclined to one side to help collect the Leachate from the Leachate collection system. It is therefore proposed that the base be raised with the help of native soil, compacted to 95% Proctor density compaction. While the soil is being compacted, measures should be taken to avoid the formation of cracks and fissures. A thick layer helps to maintain the integrity of the liner against desiccation cracks. It is advisable to compact the soil liner using a sheep foot roller, in lifts not exceeding a maximum compacted thickness of 30 cm, and the above parameters (proctor density and moisture content) should be monitored for each lift.

There should be effective bonding between successive lifts including kneading between lifts or scarification and moisture conditioning between successive lifts. Kneading or blending a thinner as well as new lift with the previously compacted lift may be achieved by using a sheep foot roller with long feet that can fully penetrate a loose lift of soil. If the protruding rods or feet of a sheep foot roller are sufficient in length to penetrate the top lift and knead the previous lift, good bonding may be achieved. Another method includes scarifying (roughening), and possibly wetting, the top inch or so of the last lift before placing the next lift. The maximum lift thickness and number of lifts is intentional to promote uniformity within each lift and reduce the probability that preferential flow paths may align and adversely impact on the hydraulic conductivity of the overall liner.

If necessity arises to tie new sections of a soil liner into an existing liner, lateral extension should be made of about 3-6 m into the existing liner in a stair stepped manner following the individual lifts of the existing liner. Materials forming the existing liner must be scarified over a minimum horizontal distance of 1 m for maximizes bonding.

A minimum horizontal overlap of 1m between successive layers must be achieved so

that preferential pathway for leachate flow is not created. The integrity of the bond between different layers of liner construction at a similar elevation should be assessed.

A smooth final surface should be graded at a minimum of 1% sloping toward the header pipes which will be a part of the overlying leachate collection system. It has been suggested that 4 header pipe be provided to reduce the height of the soil required for making necessary slopes.

The slope of the soil liner towards the header pipes have been maintained at 1%. Care should be taken to maintenance the integrity of successive lifts and the completed liner including prevention of disturbance, erosion and desiccation cracking. This can be achieved through maintaining moisture content.

The method used to place the soil liner on side slopes depends on the angle and length of the slope. Continuous placement of soil layers up the slopes will be achieved through gradual inclination from the toe of the slope and by providing better continuity between the bottom and sidewalls of the soil liner. However, when steep slopes are encountered, the soil may need to be placed and compacted horizontally, due to the difficulties of operating heavy compaction equipment on steeper slopes. At the side slopes, the soil liner should be laid in swaths which are approximately 10 metres in width and the compaction of the soil can be accomplished by running the roller up the slope, instead of across the slope - on the grade. A significant amount of additional soil liner material will be required to construct the horizontal lifts since the width of the lifts has to be wide enough to accommodate the compaction equipment. Once the soil liner is constructed on the side slopes, it can be trimmed back to the required thickness. A smooth hydraulic drum roller should be used to seal the trimmed surface of the soil liner.

5.9.5.3 QA/QC Details

The soil liner should be tested periodically prior to placement of Geomembrane-HDPE liner for adherence to prescribed standards. It is suggested that the Contractor provide the results of the following testing methods. Testing methods used to characterize proposed liner soils should include grain size distribution, Atterberg limits, and permeability.

In situ, or field, hydraulic conductivity testing is required to ascertain the quality of the liner being laid. This device is embedded into the surface of the soil liner such that the rate of flow of a liquid into the liner can be measured. The two types of infiltrometers are most widely used - open and sealed. Open rings are less desirable, since every small drop in water levels is hard to measure. With sealed rings, very low rates of flow can be measured. The sealed double-ring infiltrometer has proven to be the most successful method and is the one most widely used. The outer ring forces

infiltration from the inner ring to be more or less one-dimensional. Covering the inner ring with water insulates it substantially from temperature variation, resulting in robust and reliable readings.

5.9.5.4 Supply and Installation of Geosynthetic Clay Liner

A Geosynthetic Clay Liner is suggested on top of the finished soil layer. This is important as the base liner of the landfill must be constructed in such a way that it should take about 25 years for any percolated leachate to pass through it. Technical specifications are separately mentioned.

A. Subgrade Preparation

1. Subgrade surfaces consisting of granular soils or gravel may not be acceptable due to their large void fraction and puncture potential. In high head (greater than one foot) applications, subgrade soils should possess a particle size distribution such that at least 80 percent of the soil is finer than a #60 sieve (0.250 mm).

2. When the GCL is placed over an earthen subgrade, the subgrade surface must be in accordance with the project specifications. Engineer's approval of the subgrade must be obtained prior to installation. The finished surface should be firm and unyielding, without abrupt elevation changes, voids, cracks, or standing water.

3. The Subgrade surface must be smooth and free of vegetation, sharp-edged rocks, stones, sticks, construction debris, and other foreign matter that could contact the GCL. The subgrade should be rolled with a smooth-drum compactor to remove any wheel ruts, footprints, or other abrupt grade changes. Furthermore, all protrusions extending more than 0.5 inch (12 mm) from the subgrade surface shall be removed, crushed, or pushed into the surface with a smooth-drum compactor.

B. Installation

1. GCL rolls should be taken to the working area of the site in their original packaging. Prior to deployment, the packaging should be carefully removed without damaging the GCL. The orientation of the GCL (i.e., which side faces up) may be important if the GCL has two different geotextiles. Unless otherwise specified, however, the GCL should be installed such that the product name printed on one side of the GCL faces up.

2. Equipment which could damage the GCL should not be allowed to travel directly on it. Acceptable installation, therefore, may be accomplished such that the GCL is unrolled in front of the backwards-moving equipment. If the

installation equipment causes rutting of the subgrade, the subgrade must be restored to its originally accepted condition before placement continues.

3. If sufficient access is available; GCL may be deployed by suspending the roll at the top of the hill with a group of laborers pulling the material off of the roll and down the slope.

4. GCL rolls should not be released on the slope and allowed to unroll freely by gravity.

5. Care must be taken to minimize the extent to which the GCL is dragged across the subgrade in order to avoid damage to the bottom surface of the GCL. A temporary geosynthetic subgrade covering commonly known as a slip sheet or rub sheet may be used to reduce friction damage during placement.

6. The GCL should be placed so that seams are parallel to the direction of the slope. End-of-roll seams should also be Located at least 3 ft. (1 m) from the toe and crest of slopes steeper than 3H: 1V.

7. All GCL panels should lie flat on the underlying surface, with no wrinkles or folds, especially at the exposed edges of the panels.

8. The GCL should not be installed in standing water or during rainy weather. Only as much GCL shall be deployed as can be covered at the end of the working day with soil, a geomembrane, or a temporary waterproof tarpaulin. The GCL shall not be left uncovered overnight. If the GCL is hydrated when no confining stress is present, it may be necessary to remove and replace the hydrated material. The project engineer and CQA inspector should be consulted for specific guidance if premature hydration occurs.

C. Anchorage

1 The end of the GCL roll should be placed in an anchor trench at the top of a slope. The front edge of the trench should be rounded to eliminate any sharp corners that could cause excessive stress on the GCL. Loose soil should be removed or compacted into the floor of the trench.

2 Anchorage should be as per the project drawings and specifications. In case of difficulty, the Project Manager should be contacted for his instructions.

3 If a trench is used for anchoring the end of the GCL, soil backfill should be placed in the trench to provide resistance against pullout. The size and shape of the trench, as well as the appropriate backfill procedures, should be in accordance with the project drawings and specifications.

D. Seaming

1 GCL seams are constructed by overlapping their adjacent edges. Care should be taken to ensure that the overlap zone is not contaminated with loose soil or other debris. In some types of GCL's supplemental bentonite in granular form may be required for seaming. This should be provided as per the manufacturer's recommendations.

2 Unless otherwise specified, the minimum dimension of the longitudinal overlap should be 6 inches (150 mm). End-of-roll overlapped seams should be similarly constructed, but the minimum overlap should measure 24 inches (600 mm).

3 Seams at the ends of the panels should be constructed such that they are shingled in the direction of the grade to prevent the potential for runoff flow to enter the overlap zone. End panel overlap seams on slopes are not permissible.

4 End of panel seams are constructed first by overlapping the adjacent panels, exposing the underlying edge, and then applying a continuous bead or fillet of granular sodium bentonite (supplied with the GCL) along a zone defined by the edge of the underlying panel and the 12-inch (300 mm) Line. The minimum application rate at which the bentonite is applied is one quarter pound per linear foot (0.4 kg/m).

E. Seaming Around Penetrations & Structures

1 Cutting the GCL should be performed using a sharp utility knife. Frequent blade changes are recommended to avoid irregular tearing of the geotextile components of the GCL during the cutting process.

2 The GCL should be sealed around penetrations and structures embedded in the subgrade. Granular bentonite or a bentonite mastic shall be used liberally (approx. 2 Lbs./ln ft. or 3 kg/m) to seal the GCL to these structures.

3 When the GCL is placed over an earthen subgrade, a "notch" should be excavated into the sub-grade around the penetration. The notch should then be backfilled with granular bentonite or bentonite mastic.

4 A secondary GCL layer of 300 mm overlap should also be placed to avoid any leakages. The granular bentonite should be applied between the 1st and the 2nd GCL layers.

5 When the GCL is terminated at a structure or wall that is embedded into the subgrade on the floor of the containment area, the subgrade should be

notched as described above. The notch is filled with bentonite, and the GCL should be placed over the notch and up against the structure. The connection to the structure can be accomplished by placement of soil or stone backfill in this area.

F. Construction of Synthetic Membrane Liner

A 1.5 mm thick HDPE liner will be laid over the GCL. This layer will prevent any infiltration of leachate into the soil layer below. The sub base is properly prepared for installation of synthetic membrane. The sub base needs to be compacted as per design specifications (95% modified Proctor density for clay or amended soil). It must not contain any particles greater than 1.25 cm in order to prevent damage to the geomembrane. An organic herbicide should be used on the sub base below the synthetic membrane to inhibit vegetative growth. The liner will be laid according to the phasing plan elaborated in the drawing No. 2. The geomembrane supplier will be responsible for laying the liner and welding the liner as and where required to make it an impervious barrier. At the end of each phase, the liner will be tucked into a trench and filled with soil as shown in drawing. At the beginning of the next phase, the liner will be recovered and rolled back into the previous phase's area and will be welded to the geomembrane liner to be laid for the subsequent phase. Under no circumstances vehicles will be allowed to operate on the liner directly. Only the seaming equipment, seam testing equipment and necessary minimum number of personnel should be allowed on the liner. The geomembrane should be covered with soils, or select waste, and tarpaulin, to prevent any damage. Technical specifications are separately mentioned.

5.9.5.5 Leachate Management

When water comes in contact with the waste material and the product of waste decomposition in the landfill, leachate production takes place. It gets generated due to the permeation of rainwater and surface water into the landfill and percolation of this water through the waste layers. The compaction and degradation of waste over a period of time also results in leachate production. It is a polluted liquid that contains a number of dissolved and suspended materials. Leachate quality depends on the waste composition, temperature, moisture and availability of oxygen.

A. Leachate Collection System

The leachate collection system (LCS) consists of three main components; a drainage layer, a series of collector pipes, and a non-woven geotextile separator layer. These components are discussed in more detail below.

The leachate collection system and its components will be laid over the HDPE geomembrane. The LCS layer consists of a 30 cm thick gravel drainage layer of

12-25 mm sized rounded gravel and perforated HDPE pipes embedded in this gravel layer. The HDPE pipes will collect the leachate and are connected to a LCS tank. 1 tank has been provided for leachate collection for both cells. Leachate from the tank will be pumped to the leachate evaporation pond.

In the proposed landfill No. 1, it has been suggested that 4 header pipes be provided. The laterals are made of 160 mm OD HDPE pipes placed at a distance of 20 M each. These laterals will be attached to 4 header pipes of 315mm OD HDPE pipes, which are placed equally so that the leachate is collected from all areas. The header pipes have a slope of 1%. The header pipes are then connected to the leachate collection tank from where the leachate would be pumped to leachate evaporation pond. The leachate collection pipes must be wrapped in Non-woven geotextiles so as to reduce the clogging of the pipes.

The leachate collection piping network system consists of two parts, a network of leachate collection pipes and a LCS tank. The LC pipes are embedded in the leachate collection layer above the liner. The lateral pipes are laid at an angle to the header pipes of the landfill. There are three header pipes running along the length of the landfill and are connected to a leachate collection tank.

B. Geotextile layer

Non-woven geotextile installed above the entire gravel drainage blanket will further provide protection from clogging in the LCS. The geotextiles on top of the gravel will act as a separator layer between the drainage blanket and the protective layer and also provides additional filtering capacity to help maintaining the high permeability of the underlying drainage layer. The geotextile will cover the base and side slopes of the base and will be tucked into a trench running along the periphery of the landfill limit.

C. Protective Soil Layer

A layer of 300mm thk native soil should be placed on the non-woven geotextile. This soil layer acts as an additional filter media and prevents any large size particles from going into the leachate collection system. This layer also acts as a buffer layer so that vehicles can move without damaging the lower system. Care should be taken while placing this material in place as heavy vehicles are not allowed to move on the geotextile directly. This has to be done manually and need not be compacted. The waste of 1m is placed on this protective layer and then compacted with compactors.

In order to dump subsequent layers of waste, soil should be pushed gently by a light dozer to make a path. Dumping of soil directly on the geotextile should be avoided as much as possible. One or two main routes with 60-90 cm of soil should be created for use by heavier equipment for the purposes of soil moving.

Damage to the membrane due to traffic can be severe and undetectable and hence should be avoided at all times. The first lift of waste should be spread and compacted with light vehicles. It is preferable not to compact the first foot of waste. No bulky items should be dumped in the first lift.

Table 47: Standards for treated leachate, as per MSW Rules, 2000

Sr.No.	Parameter	Standards (Mode of Disposal)		
		Inland surface water	Public sewers	Land disposal
1	Suspended solids, mg/L, max	100	600	200
2	Dissolved solids (inorganic) mg/L, max.	2100	2100	2100
3	$_P$H value	5.5 to 9.0	5. 5 to 9.0	5.5 to 9.0
4	Ammonical nitrogen (as N), mg/L, max.	50	50	-
5	Total Kjeldahl nitrogen (as N). mg/L, max.	100	-	-
6	Biochemical oxygen demand (3 days at 27° C) max. (mg/L)	30	350	100
7	Chemical oxygen demand, mg/L, max.	250	-	-
8	Arsenic (as As). mg/L, max	0.2	0.2	0.2
9	Mercury (as Hg), mg/L, max	0.01	0.01	-
10	Lead (as Pb), mg/L, max	0.1	1	-
11	Cadmium (as Cd), mg/L, max	2	1	-
12	Total Chromium (as Cr), mg/L, max.	2	2	-
13	Copper (as Cu), mg/L, max.	3	3	-
14	Zinc (as Zn), mg/L, max.	5	15	-
15	Nickel (as Ni), mg/L, max	3	3	-
16	Cyanide (as CN), mg/L, max.	0.2	2	0.2
17	Chloride (as Cl), mg/L, max.	1000	1000	600
18	Fluoride (as F), mg/L, max	2	1.5	-
19	Phenolic compounds (as C_6H_5OH) mg/L, max.	1	5	-

Construction of the base and liner system should consider the following points:

1. Good sub grade preparation to provide a sound and stable base for liner construction.
2. The quality of the geosynthetic liner delivered to site.
3. The quality of joints in the geomembrane.
4. The risk of damage during handling, storage and installation, including that due to weather conditions, e.g. wind, rainfall and temperature.
5. Storm water management during construction

6. The risk of subsequent damage from other construction activities, such as placement of materials over the geomembrane and geotextile.
7. Storm water management on side slopes to prevent infiltration under the liner system.

5.9.5.6 Waste Placement

The objective is to emplace the waste into its final position within the landfill in accordance with the design objectives without compromising safety, environment or the local amenity. Areas where waste is to be placed should be set out for line and level in advance of tipping, so that the waste is placed in accordance with the detailed construction plan.

The waste deposition in the landfill will be started at the lowest end proceeding upwards. The profile of waste will be as shown in the details. The maximum height of waste is assumed as 15m with which the landfill capacity has been worked out. The landfill capacity mentioned above has been worked out taking into consideration the loss of volume due to daily cover as well as temporary cover before onset of monsoon. The landfill area can thus last for 5.5 years.

Every discharged load into the tipping area should be visually inspected by a designated operator. This could be a machine driver or the landfill operator depending upon the traffic density. Working area personnel should be trained and competent at waste identification in order that they can recognize waste, which may be non-confirming. In event of reasonable doubt as to the waste acceptability the operator should inform the waste reception facility or the site manager immediately. The consignment should be isolated pending further inspection.

Once the waste has been discharged from the vehicle it should be consolidated and layered to ensure that tipping areas remain well defined and tipping slopes are maintained at the designated gradients.

5.9.5.7 Waste Compaction

It is a conventional practice to level and compact the waste as soon as it is discharged at the working areas. Compaction offers many benefits including, enabling the maximum amount of waste to be emplaced within the space available, reducing the impact from litter, flies, vermin, birds and fires and minimizing short-term settlement. The waste should be compacted to a density of about 0.8 tonnes/m3 is the optimum.

5.9.5.8 Daily cover

The daily soil cover required would have to be stored at site in a demarcated area. If the soil is not available form the site itself it will have to be brought from outside and

stacked. The soil of 4 to 6 inches should be applied on the waste coming in. The advantages of using daily cover are primarily in preventing wind blow and odours, deterrence to scavengers, birds and vermin and in improving the site's visual appearance. Soils will give a pleasing uniform appearance from the site boundary.

Where cover is used for public health or nuisance protection, the cover material should be such that the permeability of the waste and cover as a whole should (Eventually) be sufficient to allow leachate to pass and gas to be extracted without creating perched conditions or preferential paths.

5.9.5.9 Intermediate Cover

Waste should be covered at the end of each working day with a daily cover. If a stretch of waste is not to be filled over in the immediate future (for example - for one week), it should be covered with a thicker interim cover. Prior to the commencement of monsoon season, an intermediate cover of 40-65 cm thickness of soil should be placed on the landfill with proper compaction and grading to prevent infiltration during monsoon. The intermediate cover will follow the slopes and grading of the underlying waste. Placement of tarpaulin covers may be required at locations where either stagnation is observed or at locations where there is a possibility of erosion of the interim cover.

5.9.6 Landfill Closure

The landfill cover system will extend above the bunds to the top of the waste. The average height of the waste would be 10 m above the bund. The Landfill will be capped as per the MSW 2000 Rules. The waste will have to be graded to the necessary stable slopes. The various layers that will be placed on the waste are gravel of 200 mm thk for the gas to be released to the gas vents. Passive Gas vents will be suitably placed in this layer so that the small quantity of gas that is formed would be released into air. The possibility of having large quantity of landfill gases is very less as the waste going into the landfill would be of inert nature. A geotextile of 350 gm/M2 would be placed on the gravel layer to separate the soil layer. A soil layer (native soil) of 600 mm thk compacted to 95% Proctor density compaction will be placed on top of the geotextile. A 150 mm thk gravel layer would be placed as a drainage layer over which a soil layer of 450 mm thk would be placed for vegetation. The 150 mm thk gravel layer would help in draining of the excessive water entering the topsoil layer.

The Final Closure work would have to be carried out in all cells with the quantum of Closure differing at each phase. It is important to note that with the final Closure in place, there would be an advantage of reducing your Leachate substantially.

5.9.6.1 Gas Collection layer

The first layer to be placed over the waste is a 200 mm thick gas-venting layer constituting 12- 25 mm sized rounded gravel. In this gravel are embedded gas-venting pipes. The position of gas venting pipes for landfill No.1 is shown in drawing enclosed. A gas-venting pipe has been provided for every 2500 m2 of top cover. This is so done, as the waste going into the landfill are the rejects of the composting process and the inert material collected from the system. Very little gas is expected from the landfill because of its inert nature. Care is to be taken to embed the gas collection pipes in the gravel layer.

5.9.6.2 Placement of Geotextile

A geotextile cover will be placed over the gas-venting layer, which will act as a barrier between the overlying soil layer and the gravel layer of the gas collection layer. At the periphery of the landfill, this geotextile is tucked into the peripheral trench.

5.9.6.3 Compacted Clay Layer

A 600 mm. compacted clay liner will be laid over the geotextile. This layer will act as a primary barrier to prevent the infiltration of runoff water into the sanitary landfill. The clay liner should have a permeability less than or equal to 5 X 10-7 cm/s.

The placement of clay liner must meet the following requirements:

- Modified proctor density: 95%
- Moisture content: 5-7%

While clay is being compacted, measures should be taken to avoid the formation of cracks and fissures. A thick layer will help to maintain the integrity of the liner against desiccation cracks. It is advisable to compact the clay liner using a sheep foot roller, in lifts of not exceeding a maximum compacted thickness of 30 cm, and the above parameters (proctor density and moisture content) are monitored for each lift.

There must be effective bonding between successive lifts that includes kneading between lifts or scarification and moisture conditioning between successive lifts. Kneading or blending a thinner, new lift with the previously compacted lift may be achieved by using a footed roller with long feet that can fully penetrate a loose lift of clay. If the protruding rods or feet of a sheep foot roller are sufficient in length to penetrate the top lift and knead the previous lift, good bonding may be achieved. Another method includes scarifying (roughening), and possibly wetting, the top inch or so of the last lift before placing the next lift. The maximum lift thickness and number of lifts is intended to promote uniformity within each lift and reduce the probability that preferential flow paths may align and adversely impact on the hydraulic conductivity of the overall liner.

If it is necessary to tie in new sections of a clay liner into an existing liner, lateral extension should be made about 3-6 m into the existing liner in a stair stepped manner following the individual lifts of the existing liner. Materials forming the existing liner must be scarified over a minimum horizontal distance of 1 m to maximize bonding.

A minimum horizontal overlap of 1m between successive layers must be achieved to have confidence that a preferential pathway for leachate flow is not being created. It is important to assess the integrity of the bond between different layers of liner construction at a similar elevation.

The method used to place the clay liner on side slopes depends on the angle and length of the slope. Gradual inclines from the toe of the slope enable continuous placement of clay layers up the slopes and provide better continuity between the bottom and sidewalls of the clay liner. When steep slopes are encountered, however, the clay may need to be placed and compacted horizontally due to the difficulties of operating heavy compaction equipment on steeper slopes. At the side slopes, the clay liner should be laid in swaths which are approximately 10 metres in width and the compaction of the clay should be accomplished by running the roller up the slope, instead of across the slope - on the grade.

As is suggested in the liner placement drawing No. 4 and the cross section drawing of phase 1, the clay liner should extend to the top of the side slopes and should tie in with the clay liner of the top cover, as and when the cover is placed. A significant amount of additional clay liner material will be required to construct the horizontal lifts since the width of the lifts has to be wide enough to accommodate the compaction equipment. After the clay liner is constructed on the side slopes using this method, it can be trimmed back to the required thickness. A smooth hydraulic drum roller should be used to seal the trimmed surface of the clay liner.

5.9.6.4 QA/QC Details

The clay liner should be tested periodically prior to placement of drainage layer. It is suggested that the Contractor provide the results of the following testing methods. Testing methods used to characterize proposed liner soils should include grain size distribution, Atterberg limits, and permeability.

5.9.6.5 Primary Drainage Cover and Topsoil

A primary drainage cover, 200 mm thick, constituting gravel 12-25 mm in size will be laid over the clay cover to drain the runoff percolating from the topsoil into the peripheral stormwater trenches. Over the drainage cover, the final top cover layer, 450 mm of topsoil will be placed. The topsoil should be seeded with appropriate plant species having minimal root depth in order to maintain the integrity of the top most layers.

5.9.6.6 Vegetative Cover

The main aim of the vegetative cover is to see that topsoil cover is not eroded. In order to do so, the MSW 2000 Rules, suggest a vegetative cover that should be provided over the completed site in accordance with the following specifications:

1. Selection of locally adopted non-edible perennial plants which are resistant to drought and extreme temperatures
2. Plants grown should be such that their roots do not penetrate more than 30 mm. This condition shall apply till the landfill is stabilized.
3. Selected plants should have ability to thrive on low-nutrient soil with minimum nutrient addition.

5.9.6.7 Stormwater Management

The landfill cover system is designed to minimize infiltration into the waste. The top two cover layers - the topsoil and the drainage layer drain into the peripheral stormwater drains built along the 4 sides of the landfill around the perimeter. The trenches will be trapezoidal channels made in brick work on the side slopes and will have native soil at the base, to promote growth of grass. The stormwater trenches drain runoff only from the landfill area and will open into the proposed stormwater management pond. The storm water drains will open in lower most drain, from where the water will be taken to the pond and then let out in the natural water course.

The maximum runoff will occur when the landfill is completed, as the surface area would be maximum. The landfill top will mainly have a 2% slope. The top will be divided into 4 regions so that the rainwater does not percolate into the landfill but will flow off as fast as possible. This will help in reducing the infiltration and thus reducing the formation of Leachate. There are drains provided at berms to facilitate the smooth flow of water into the storm drains that are located at the bottom of the landfill. Depending upon the site conditions, the storm water should be channeled into the nearest nalla. A pond could also be made to store this water and then use for irrigating the green belt.

5.9.7 Landfill Cells and Cell Wise Construction

It is proposed to operate the landfill in two distinct cells in the 48.13 acre plot. The size of the proposed cells in the new landfill site is shown in table given below.

Table 48: Landfill Cell design life

For the First 5.5 Years			
Cell	**Period**	**Vol. Provided (M3)**	**Life(Years)**
1	**2007-09**	**400000**	**3**
2	**2010-12**	**460000**	**2.5**
	Total	**8,60,000**	**5.5**
For the Next 20 Years			
Cell	**Period**	**Vol. Provided (M3)**	**Life(Years)**
1	**2007-09**	**400000**	**3**
2	**2010-12**	**460000**	**2.5**
	Total	**8,60,000**	**5.5**

5.9.8 Monitoring Requirements

5.9.8.1 Groundwater Quality Monitoring

According to MSW Rules, 2000, specified groundwater monitoring requirements are as follows:

Before establishing any landfill site, baseline data of ground water quality in the area shall be collected and kept in record for future reference. The ground water quality within 50 meters of the periphery of landfill site shall be periodically monitored to ensure that the ground water is not contaminated beyond acceptable limit as decided per the Ground Water Board or the State Board or the Committee. Such monitoring shall be carried out to cover different seasons in a year that is, summer, monsoon and post-monsoon period.

Usage of groundwater in and around landfill sites for any purpose (including drinking and irrigation) is to be considered after ensuring its quality. Groundwater samples are to be collected quarterly and analyzed for the following parameters, as suggested by MSW Rules, 2000. "The following specifications for drinking water quality shall apply for monitoring purpose, namely:"

Table 49: Standards for Groundwater Quality Monitoring

S.No.	Parameters	Is 10500: 1991 Desirable Limit (Mg/L Except For Ph)
1.	Arsenic	0.05
2.	Cadmium	0.01
3.	Chromium	0.05
4.	Copper	0.05
5.	Cyanide	0.05

6.	Lead	0.05
7.	Mercury	0.001
8.	Nickel	-
9.	Nitrate As No_3	45.0
10.	pH	6.5-8.5
11.	Iron	0.3
12.	Total Hardness (As $Caco_3$)	300.0
13.	Chlorides	250
14.	Dissolved Solids	500
15.	Phenolic Compounds (As C_6h_5oh)	0.001
16.	Zinc	5.0
17.	Sulphate (As So_4)	200

In addition, the initial testing should include bacteriological parameters such as total coliform, faecal coliform and faecal streptococci. Such testing could be done from time to time, but is not required as a routine.

Proper sampling and analysis protocols should be followed to ensure that, the results obtained are correct. It is highly recommended that a specialist be hired to undertake the sampling and analysis. The Operator is responsible for preparing an appropriate quality control/quality assurance procedure. For example, a blind sample could be considered for each sampling round.

Annual reporting on the results of the groundwater-monitoring program should be forwarded to the Pollution Control Board. The report should undertake analysis of trends in the data to show potential impacts from the landfill. Prediction of future off-site contamination is to be undertaken as part of the analysis.

Based on the results of the monitoring, additional environmental control systems may be required. These contingency measures should be developed when the monitoring indicates a future problem is imminent. The ground water must be monitored for 15 years after the closure of the landfill.

5.9.8.2 Ambient Air Quality Monitoring

Ambient air quality monitoring should be carried out 4 times a year, as suggested by MSW Rules, 2000. The parameters to be monitored and the prescribed standards as follows:

Table 50: Standards for Air Quality Monitoring

Sr. No.	Parameters	Acceptable levels
(i)	Sulphur dioxide	120
(ii)	Suspended Particulate Matter	500
(iii)	Methane	Not to exceed 25 per cent of the lower explosive limit (equivalent to 650 mg/m^3)
(iv)	Ammonia daily average (Sample duration 24 hrs)	0.4 mg/m^3 (400
(v)	Carbon monoxide	1 hour average: 2 mg/m^3 8 hour average: 1 mg/m^3

It is proposed to monitor air quality in three to five locations around the site. Landfill gas quantity and quality measurements are included in the overall air quality-monitoring programme. Portable methane detection units should be used to test for methane concentrations in monitoring wells, at the fill surface and at various points within and just outside the site boundaries. Measurements of landfill gas concentrations just outside the site boundaries are very important to ensure that gas is not migrating offsite to neighboring lands. Portable methane detection units are readily available and would be simple to operate by landfill personnel with minimal training. The Air quality must be monitored for 15 years after the closure of the landfill.

5.9.8.3 Surface Water Monitoring

A long-term monitoring programme should be established to monitor any impact from the landfill on the quality of surface water. Monitoring should commence prior to and early in the construction period to establish the baseline conditions.

Monitoring surface water chemistry at the site will be valuable for ongoing monitoring of any environmental impacts associated with landfill operations. Chlorides and conductivity are generally accepted indicators of leachate contamination that can be analyzed using field test kits at minimal cost to the operators.

Stormwater collected in the stormwater retention pond needs to be monitored periodically to check for any deviations from the prescribed standards. Given that only municipal solid waste is handled at the landfill and that all precautions are taken to prevent runoff from coming in contact with the waste, it is considered safe to use the stormwater runoff for on-land irrigation purposes. It is proposed that the quality of stormwater runoff be monitored once every quarterly, after the occurrence of any rainfall event. Samples should also be collected after every major storm event, particularly during the monsoon season. Since, this water is to be used for onsite application; it should meet with standards for treated leachate for land disposal. The surface water must be monitored for 15 years after the closure of the landfill.

5.9.9 Closure of Landfill Site and Post- Closure Care

The post-closure care of landfill site should be conducted for at least fifteen years and the following conditions should be continually monitored

- Maintaining the integrity and effectiveness of final cover, making repairs and preventing run-on and run-off from eroding or otherwise damaging the final cover.
- Monitoring leachate collection system in accordance with the standards specified
- Maintaining groundwater quality and monitoring of ground water in accordance with standards specified
- Maintaining the passive venting landfill gas collection system to meet standards

Use of the closed landfill site after fifteen years of post-closure monitoring can be considered for gardens, golf courses, parks apart from human settlement.

5.9.10 Costing;

The Closure of existing open dumps in the city are handled in 3 Alternatives A, B & C. The costs of these are given below. The cost of Landfill No.1 & 2 with its Closure is considered. The cost of other infrastructure to be constructed at the composting cum landfill site is also given for the 48.13 acre plot.

Table 51: Expenses for Closure (A.B & C) & landfill on Plot of 48.13 acre -- For first 5.5 years

Sr. No.	Item of Expenditure	Quantity Required	Total cost (Rs)	Total Expenditure (in Rs.)
1	Closure of Existing waste dumps			
	Alternative A	1	7,412,233	7,412,233
	Alternative B	1	10,340,088	10,340,088
	Alternative C	1	2,996,749	2,996,749
	Sub Total A			**20,749,070**
2	Baseline Data Collection	1	379,100	379,100
3	Landfill No.1 & 2 (5.5 years capacity)	1	103,796,302	103,796,302
4	Bulldozer - D-80-180HP Landfill Equipment	1	10,000,000	10,000,000
5	Wheel dozer	1	6,500,000	6,500,000
6	Tippers - Landfill Equipment	5	1,200,000	6,000,000
7	JCB- Landfill Equipments	1	2,500,000	2,500,000
8	Compound wall around the landfill - 1710Rmt @860/RMT	1	1,470,600	1,470,600
9	Office Bldg & Lab	1	1,200,000	1,200,000
10	Weigh Bridge with civil structure	1	770,000	770,000
11	Vehicle Maintenance and store	1	750,000	750,000
12	Security cabin	1	25,000	25,000

13	Plantation-5130 M2 @ 100/M2	1	513,000	513,000
14	Roads-6840 M2 @350/M2	1	2,394,000	2,394,000
	Sub Total B			**136,298,002**
15	Closure No.1 & 2 (5.5 years capacity) **[Not included in the capital cost]**	1	57,896,420	57,896,420

For next 20 years

As the proposed landfill is of 48.13 acres, it will suffice only for 5.5 years, so it is been suggested to Nagar Nigam Varanasi that a new landfill site should be identified, which will last for next 20 years and have an area not less than 125 acres. For this landfill no additional equipment cost will be required. Items to be included for costing of new landfill are as mentioned in table below:

Table 52: Expenses for Landfill on Plot of 125 acre -- For next 20 years

Sr. No.	Item of Expenditure	Quantity Required	Total cost (Rs)	Total Expenditure (in Rs.)
1	Baseline Data Collection	1	725,650	7,25,650
2	Compound wall around the landfill – 3023.5Rmt @860/RMT	1	2,600,210	2,600,210
3	Office Bldg & Lab	1	1,200,000	1,200,000
4	Weigh Bridge with civil structure	1	770,000	770,000
5	Vehicle Maintenance and store	1	750,000	750,000
6	Security cabin	1	25,000	25,000
7	Plantation-5130 M2 @ 100/M2	1	907,050	907,050
8	Roads-6840 M2 @350/M2	1	4,232,900	4,232,900
	Total			**11,210,810**

Annual Operational cost estimates includes administration staff, labour, equipment maintenance, leachate, ground water, and environmental monitoring works would be about Rs. 250/ Mt of waste going into the landfill.

Memorandum showing items of work to be carried out

SCHEDULE - "B"

Table 53: Civil Work for M.S.W Landfill site for Cell 1 (Part-I)

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	Excavation in Earth , soil of all types, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for Landfill and necessary backfilling, ramming, watering including shoring and strutting etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	98553.15	30.00	2956594.46
2	Laying & spreading of recommended				

	Soil - 500mm thk as soil cover including leveling to required level, watering etc. comp. with all other allowances.				
	As Per Schedule of rates, Varanasi	Cum	10529.94	190.00	2000687.65
3	Providing and spreading Protective Soil - 300mm thk over Landfill Base, sand filter layer & Bund slope at site, to the required lines, curves, grade and section, for a consolidated thickness of 300 mm, including conveying etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	11097.22	190.00	2108472.08
4	Providing and spreading Gravel - 300mm thk at the site for Filter Layer to the required lines, curves, grade and section, including conveying, as directed. Material made up of diameter not less than 2.5 mm for Gravel and not more than 4.0 mm to function as a passage for the leachate to be collected in the pipe. The hydraulic conductivity of the layer should be no less than 1 x 10.0 cm/sec and it should be free from debris/soil.				
	As Per Schedule of rates, Varanasi	Cum	6460.88	833.00	5381911.37
5	Providing Earthwork in Embankment with approved materials obtained from departmental land or other sources including all lifts, laying in layers of 20 cm to 30 cm thickness breaking clods, dressing to the required lines, curves, grade and section, watering and compaction to 95% of Standard Proctor Density, complete with Vibratory Power roller, etc. complete.				
(i)	For Bund	Cum	14018.94	31.00	434587.14
	As Per Schedule of rates, Varanasi				
6	Total Civil Work for Storm Water Gutter				
(a)	Excavation in Earth, Soil of all types, for Storm Water Gutter, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for the Gutter and necessary backfilling, ramming, watering including shoring and stutting etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	590.32	30.00	17709.72
(b)	Providing & Laying in site Cement Concrete in 1:5:10 for Storm Water Gutter, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
	As Per Schedule of rates, Varanasi	Cum.	117.22	1080.00	126599.20

(c)	Providing Second class Burnt Brick Masonary for Storm Water Gutter, with conventional/I.S. type bricks in cement mortor 1:4, including bailing out water, striking joints on unexposed faces, racking out joints on exposed faces & watering, complete.	Cum			
	As Per Schedule of rates, Varanasi		193.96	1360.00	263790.50
(d)	Providing Internal Cement Plaster 12 mm thick for Storm Water Gutter, in a single coat in cement mortor 1:4, without neeru finish to concrete or brick surface, in all positions including scaffolding and curing complete.				
	As Per Schedule of rates, Varanasi	Sqm	1264.98	42.00	53129.16
(e)	Providing Rough Cast Cement Plaster for Storm Water Gutter, externally in Two coats to concrete or brick masonary surface, in all positions with base coat of 12 to 15 mm thick in C.M. 1: 4 and rough cast treatment 12 mm thick in proportion C.M. 1:1:5 including scaffolding and fourteen days curing complete.				
	As Per Schedule of rates, Varanasi	Sqm	1399.91	75.00	104993.34
7	Total Civil Work for Chambers				
(a)	Excavation in Earth, Soil of all types, for Collection Chambers, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for the Chambers and necessary backfilling, ramming, watering including shoring and stutting etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	32.00	30.00	960.00
(b)	Providing & Laying in site Cement Concrete in 1:5:10 for Collection Chambers, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
	As Per Schedule of rates, Varanasi	Cum	9.75	1080.00	10524.90
(c)	Providing Second class Burnt Brick Masonry for Collection Chambers, with conventional/I.S. type bricks in cement mortor 1:6, including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces & watering, complete.				
	As Per Schedule of rates, Varanasi	Cum	52.62	1280.00	67358.72
(d)	Providing Internal Cement Plaster 20 mm thick for Collection Chambers, in a single coat in cement mortor 1:4, without neeru finish to concrete or brick surface, in all positions including scaffolding and curing complete.				
	As Per Schedule of rates, Varanasi	Sqm	71.04	42.00	2983.68

(e)	Providing Rough Cast Cement Plaster externally in Two coats for Collection Chambers to concrete or brick masonary surface, in all positions with base coat of 12 to 15 mm thick in C.M. 1: 4 and rough cast treatment 12 mm thick in proportion C.M. 1:1:5 including scaffolding and fourteen days curing complete.				
	As Per Schedule of rates, Varanasi	Sqm	74.40	75.00	5580.00
(f)	Providing and fixing Reinforced Cement Concrete cover of 75 mm thick over Collection Chambers, including TOR Steel reinforcement etc. complete.				
	As Per Schedule of rates, Varanasi	No	16.00	850.00	13600.00
8	Total civil work for leachate collection tank				
(a)	Excavation in Earth, Soil of all types, for Collection Chambers, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for the Chambers and necessary backfilling, ramming, watering including shoring and stutting etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	362.06	30.00	10861.92
(b)	Providing and Laying Dry Rubble Masonry foundation including leveling, compacting, watering etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	27.66	1504.00	41602.26
(c)	Providing & Laying in site Cement Concrete in 1:5:10 for Collection Chambers, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
	As Per Schedule of rates, Varanasi	Cum	9.22	1080.00	9957.99
(d)	Reinforced Cement Concrete 1:1:2 machine mixed & vibrating the concrete excluding steel reinforcement, including centering and shuttering for Slab with all allowances.				
	As Per Schedule of rates, Varanasi	Cum	166.19	4422.00	734912.11
(e)	Providing & placing Cold Twisted Deformed (ribbed for steel) Bars, as per design, for RCC works where not included in the complete rate of RCC, including bending & binding in position, including cost of binding wire, etc complete.				
	As Per Schedule of rates, Varanasi	Kgs	4172.33	32.15	134140.50
9	Grassing with 'Doob' grass including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing including supplying good earth if needed (the good earth shall be paid for separately) In rows 15 cm apart in either direction.				

	As Per Schedule of rates, Varanasi	100 Sqm	51.52	128.00	6594.64
10	Providing & fixing Cast iron submersible pumps with 100 mm dia. Delivery pipe or as per manufacturers specification, 100 mm solid handling capacity including pedestal coupling, guide rail pipe, lifting chain, non return ball valve, duckfoot bend, control panel & electric cable etc. all accessories complete for leachate pumping from leachate holding tank to slurry mixing tank as per standard design and drawings.4 H.P. & 12 M head.				
	As Per Schedule of rates, Varanasi	No	2.00	30000.00	60000.00
11	Leachate Evaporation Pond				
(a)	Providing Earthwork in Embankment with approved materials obtained from departmental land or other sources including all lifts, laying in layers of 20 cm to 30 cm thickness breaking clods, dressing to the required lines, curves, grade and section, watering and compaction to 95% of Standard Proctor Density, complete with Vibratory Power roller, etc. complete.				
(I)	For Bund	Cum	243.00	31.00	7533.00
	As Per Schedule of rates, Varanasi				
(b)	50mm thk. 1:2:4 plain cement concrete floor with cement, approved coarse and 2 cm. Graded approved stone ballast laid in panels finished with 3mm floating coat of neat cement or cement and marble dust in ratio of 5:1 as specified over and including 8 cm. thick base concrete consisting of cement, local sand and brick ballast 4 cm. Gauge in the proportion of 1:4:8 and removing any overlapping mortar at the joints of the panels if any and giving them a uniform finish, including supply of all materials, lab our, T & P etc. required for proper completion of the work.				
	As Per Schedule of rates, Varanasi	Sqm	389.00	320.00	124480.00
(c)	Grassing with 'Doob' grass including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing including supplying good earth if needed (the good earth shall be paid for separately) In rows 15 cm apart in either direction.				
	As Per Schedule of rates, Varanasi	100 Sqm	1.40	128.00	179.20
			Total Amount		**14679743.55**

SCHEDULE - "B"

Table 54: Geotechnical Work for M.S.W Landfill site for cell 1 (Part-II)

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
	Landfill				
1	Supply & install non-woven geotextile (GT) of 350 g/M^2 made of Polypropylene of TC Mirafi (USA) / Polyfelt (Austria) / Synthetic Industries (USA) / Amoco Fabrics, (USA) Nauefaser Technic GSE (Germany) make or from its regional offices as per details given in General Specifications, spreading on the filter (Gol Bajari) layer or Geomembrane as per direction of the Engineer without damaging the GT or GM. The Geotextile must be placed along the slope from top to bottom with an overlap of 100mm. It should be stitched with HDPE thread. Geotextile must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, stitching, wastage complete. Measurement will be made as per finished surface area. Geotextile in the anchor trench will be taken in measurement.				
	As per M.R	Sqm	36568.99	150.00	5485348.05
2	Supply & install 1.5 mm thk HDPE smooth Geomembrane Liner by Blown/Flat die cast process as per list of companies approved in the detailed specification, laying, anchoring in trench, seaming, testing complete as given in General Specification complete to form an impervious barrier as shown in drawings and as per the Engineer's directions. Minimum width of the Liner shall be 5M. Geomembrane must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, wastage, testing and extrusion rods complete. Measurement will be made as per finished surface area. Liner in the anchor trench will be taken in measurement.				
	As M.R	Sqm	36656.87	310.00	11363631.00

3	Supply & install Geosynthetic Clay Liner laying, anchoring in trench, seaming, testing complete as given in General Specification complete to form an impervious barrier as shown in drawings and as per the Engineer's directions. Minimum width of the Liner shall be 4.9M. GCL must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, wastage, and testing including bentonite powder at joints etc. complete. Measurement will be made as per finished surface area. GCL in the anchor trench will be taken in measurement.				
	As per M.R	Sqm	36656.87	320.00	11730199.74
	Leachate Evaporation Pond				
1	Supply & install 1.5 mm thk HDPE smooth Geomembrane Liner by Blown/Flat die cast process as per list of companies approved in the detailed specification, laying, anchoring in trench, seaming, testing complete as given in General Specification complete to form an impervious barrier as shown in drawings and as per the Engineer's directions. Minimum width of the Liner shall be 5M. Geomembrane must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, wastage, testing and extrusion rods complete. Measurement will be made as per finished surface area. Liner in the anchor trench will be taken in measurement.				
	As M.R	Sqm	389.00	310.00	120590.00
2	Supply & install Geosynthetic Clay Liner laying, anchoring in trench, seaming, testing complete as given in General Specification complete to form an impervious barrier as shown in drawings and as per the Engineer's directions. Minimum width of the Liner shall be 4.9M. GCL must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, wastage, and testing including bentonite powder at joints etc. complete. Measurement will be made as per finished surface area. GCL in the anchor trench will be taken in measurement.				
	As per M.R	Sqm	389.00	320.00	124480.00
5	Providing & Laying Perforated HDPE Pipes of 315 mm OD, of Grade PE 80, 10 Kg/M2, as per details, with proper fusion & slope, suitably placed in the soil, for Leachate conveying. Including excavation, proper base supports, backfilling etc complete.				
	As per M.R	Rmt	505.88	4419.00	2235483.72

6	Providing & Laying Perforated HDPE Pipes of 160 mm OD, of Grade PE 80, 10 Kg/M2, as per details, with proper fusion & slope, suitably placed in the soil, for Leachate conveying. Including excavation, proper base supports, backfilling etc complete.				
	As per M.R	Rmt	1059.84	1146.00	1214576.64
7	Providing & laying concrete pipes if I.S.NP.class of 300 mm diameter in proper line, level & slope including necessary collars, excavation, laying, fixing with collars in cement mortar 1:1 and refilling the trench complete.				
	As per M.R	Rmt	305.08	243.00	74134.44
	Total Amount	**32348443.60**			

SCHEDULE - "B"

Table 55: Civil Work for M.S.W Landfill site for cell 2 (Part-I)

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	Excavation in Earth , soil of all types, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for Landfill and necessary backfilling, ramming, watering including shoring and strutting etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	137578.34	30.00	4127350.08
2	Laying & spreading of recommended Soil - 500mm thk as soil cover including leveling to required level, watering etc. comp. with all other allowances.				
	As Per Schedule of rates, Varanasi	Cum	15571.70	190.00	2958623.00
3	Providing and spreading Protective Soil - 300mm thk over Landfill Base, sand filter layer & Bund slope at site, to the required lines, curves, grade and section, for a consolidated thickness of 300 mm, including conveying etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	12722.26	190.00	2417228.64
4	Providing and spreading Gravel - 300mm thk at the site for Filter Layer to the required lines, curves, grade and section, including conveying, as directed. Material made up of diameter not less than 2.5 mm for Gravel and not more than 4.0 mm to function as a passage for the leachate to be collected in the pipe. The hydraulic conductivity of the layer should be no less than 1 x 10.0 cm/sec and it should be free from debris/soil.				
	As Per Schedule of rates, Varanasi	Cum	9479.61	833.00	7896515.13
5	Providing Earthwork in Embankment with approved materials obtained from departmental land or other sources				

	including all lifts, laying in layers of 20 cm to 30 cm thickness breaking clods, dressing to the required lines, curves, grade and section, watering and compaction to 95% of Standard Proctor Density, complete with Vibratory Power roller, etc. complete.				
(i)	For Bund As Per Schedule of rates, Varanasi	Cum	10175.04	31.00	315426.24
6	Total Civil Work for Storm Water Gutter				
(a)	Excavation in Earth, Soil of all types, for Storm Water Gutter, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for the Gutter and necessary backfilling, ramming, watering including shoring and stutting etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	417.45	30.00	12523.35
(b)	Providing & Laying in site Cement Concrete in 1:5:10 for Storm Water Gutter, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
	As Per Schedule of rates, Varanasi	Cum.	82.89	1080.00	89524.06
(c)	Providing Second class Burnt Brick Masonary for Storm Water Gutter, with conventional/I.S. type bricks in cement mortor 1:4, including bailing out water, striking joints on unexposed faces, racking out joints on exposed faces & watering, complete.				
	As Per Schedule of rates, Varanasi	Cum	137.16	1360.00	186538.28
(d)	Providing Internal Cement Plaster 12 mm thick for Storm Water Gutter, in a single coat in cement mortor 1:4, without neeru finish to concrete or brick surface, in all positions including scaffolding and curing complete.				
	As Per Schedule of rates, Varanasi	Sqm	894.53	42.00	37570.05
(e)	Providing Rough Cast Cement Plaster for Storm Water Gutter, externally in Two coats to concrete or brick masonary surface, in all positions with base coat of 12 to 15 mm thick in C.M. 1: 4 and rough cast treatment 12 mm thick in proportion C.M. 1:1:5 including scaffolding and fourteen days curing complete.				
	As Per Schedule of rates, Varanasi	Sqm	989.94	75.00	74245.58
7	**Total Civil Work for Chambers**				
(a)	Excavation in Earth, Soil of all types, for Collection Chambers, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for the Chambers and necessary backfilling, ramming, watering including shoring and stutting etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	44.00	30.00	1320.00
(b)	Providing & Laying in site Cement Concrete in 1:5:10 for Collection				

	Chambers, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
	As Per Schedule of rates, Varanasi	Cum	13.40	1080.00	14471.74
(c)	Providing Second class Burnt Brick Masonry for Collection Chambers, with conventional/I.S. type bricks in cement mortor 1:6, including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces & watering, complete.				
	As Per Schedule of rates, Varanasi	Cum	68.41	1280.00	87566.34
(d)	Providing Internal Cement Plaster 20 mm thick for Collection Chambers, in a single coat in cement mortor 1:4, without neeru finish to concrete or brick surface, in all positions including scaffolding and curing complete.				
	As Per Schedule of rates, Varanasi	Sqm	94.08	42.00	3951.36
(e)	Providing Rough Cast Cement Plaster externally in Two coats for Collection Chambers to concrete or brick masonary surface, in all positions with base coat of 12 to 15 mm thick in C.M. 1: 4 and rough cast treatment 12 mm thick in proportion C.M. 1:1:5 including scaffolding and fourteen days curing complete.				
	As Per Schedule of rates, Varanasi	Sqm	96.72	75.00	7254.00
(f)	Providing and fixing Reinforced Cement Concrete cover of 75 mm thick over Collection Chambers, including Tor Steel reinforcement etc. complete.				
	As Per Schedule of rates, Varanasi	No	22.00	850.00	18700.00
8	Grassing with 'Doob' grass including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing including supplying good earth if needed (the good earth shall be paid for separately) In rows 15 cm apart in either direction.	Sqm			
	As Per Schedule of rates, Varanasi	100	36.82	128.00	4713.41
9	Providing & fixing Cast iron submersible pumps with 100 mm dia. Delivery pipe or as per manufacturers specification, 100 mm solid handling capacity including pedestal coupling, guide rail pipe, lifting chain, non return ball valve, duckfoot bend, control panel & electric cable etc. all accessories complete for leachate pumping from leachate holding tank to slurry mixing tank as per standard design and drawings.4 H.P. & 12 M head.				
	As Per Schedule of rates, Varanasi	No	2.00	30000.00	60000.00
			Total Amount		**18313521.24**

SCHEDULE - "B"

Table 56: Geotechnical Work for M.S.W Landfill site for Cell 2 (Part-II)

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
	Landfill				
1	Supply & install non-woven geotextile (GT) of 350 g/M^2 made of Polypropylene of TC Mirafi (USA) / Polyfelt (Austria) / Synthetic Industries (USA) / Amoco Fabrics, (USA) Nauefaser Technic GSE (Germany) make or from its regional offices as per details given in General Specifications, spreading on the filter (Gol Bajari) layer or Geomembrane as per direction of the Engineer without damaging the GT or GM. The Geotextile must be placed along the slope from top to bottom with an overlap of 100mm. It should be stitched with HDPE thread. Geotextile must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, stitching, wastage complete. Measurement will be made as per finished surface area. Geotextile in the anchor trench will be taken in measurement.				
	As per M.R	Sqm	42661.07	150.00	6399159.75
2	Supply & install 1.5 mm thk HDPE smooth Geomembrane Liner by Blown/Flat die cast process as per list of companies approved in the detailed specification, laying, anchoring in trench, seaming, testing complete as given in General Specification complete to form an impervious barrier as shown in drawings and as per the Engineer's directions. Minimum width of the Liner shall be 5M. Geomembrane must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, wastage, testing and extrusion rods complete. Measurement will be made as per finished surface area. Liner in the anchor trench will be taken in measurement.				
	As M.R	Sqm	42622.06	310.00	13212837.05

3	Supply & install Geosynthetic Clay Liner laying, anchoring in trench, seaming, testing complete as given in General Specification complete to form an impervious barrier as shown in drawings and as per the Engineer's directions. Minimum width of the Liner shall be 4.9M. GCL must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, wastage, and testing including bentonite powder at joints etc. complete. Measurement will be made as per finished surface area. GCL in the anchor trench will be taken in measurement.				
	As per M.R	Sqm	42622.06	320.00	13639057.60
4	Providing & Laying Perforated HDPE Pipes of 315 mm OD, of Grade PE 80, 10 Kg/M2, as per details, with proper fusion & slope, suitably placed in the soil, for Leachate conveying. Including excavation, proper base supports, backfilling etc complete.				
	As per M.R	Rmt	685.00	4419.00	3027015.00
5	Providing & Laying Perforated HDPE Pipes of 160 mm OD, of Grade PE 80, 10 Kg/M2, as per details, with proper fusion & slope, suitably placed in the soil, for Leachate conveying. Including excavation, proper base supports, backfilling etc complete.				
	As per M.R	Rmt	1800.00	1146.00	2062800.00
6	Providing & laying concrete pipes if I.S.NP.class of 300 mm diameter in proper line, level & slope including necessary collars, excavation, laying, fixing with collars in cement mortar 1:1 and refilling the trench complete.				
	As per M.R	Rmt	468.00	243.00	113724.00
			Total Amount		**38454593.40**

Table 57: Civil Work for M.S.W Closure for cell 1 (Part III)

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	Providing and spreading Gravel at the site for Filter Layer to the required lines, curves, grade and section, including conveying, as directed. Material made up of diameter not less than 2.5 mm for Gravel and not more than 4.0 mm to function as a passage for the leachate to be collected in the pipe. The hydraulic conductivity of the layer should be no less than 1 x 10.0 cm/sec and it should be free from debris/soil.				
	As Per Schedule of rates, Varanasi	Cum	14337.23	833.00	11942910.38
2	Providing and spreading Protective Soil over Landfill Base, sand filter layer & Bund slope at site, to the required lines, curves, grade and section, for a consolidated				

	thickness of 300 mm, including conveying etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	44489.19	190.00	8452946.73
3	Total civil work for surface drains				
(a)	Excavation in Earth, Soil of all types, for Collection Chambers, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for the Chambers and necessary backfilling, ramming, watering including shoring and stutting etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	715.76	30.00	21472.8
(b)	Providing Second class Burnt Brick Masonry for Collection Chambers, with conventional/I.S. type bricks in cement mortor 1:6, including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces & watering, complete.				
	As Per Schedule of rates, Varanasi	Cum	210.58	1280.00	269536.512
(c)	Providing Internal Cement Plaster 20 mm thick for Collection Chambers, in a single coat in cement mortor 1:4, without neeru finish to concrete or brick surface, in all positions including scaffolding and curing complete.				
	As Per Schedule of rates, Varanasi	Sqm	1805.69	42.00	75838.812
4	Grassing with 'Doob' grass including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing including supplying good earth if needed (the good earth shall be paid for separately) In rows 15 cm apart in either direction.				
	As Per Schedule of rates, Varanasi	100 Sqm	490.36	128.00	62765.91616
			Total Amount		**20825471.15**

Table 58: Geotechnical Work for M.S.W Closure for cell 1 (Part-IV)

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	Supply & install non-woven geotextile (GT) of 350 g/M^2 made of Polypropylene of TC Mirafi (USA) / Polyfelt (Austria) / Synthetic Industries (USA) / Amoco Fabrics, (USA) Nauefaser Technik GSE (Germany) make or from its regional offices as per details given in General Specifications, spreading on the filter (Gol Bajari) layer or Geomembrane as per direction of the Engineer without damaging the GT or GM. The Geotextile must be placed along the slope from top to bottom with an overlap of 100mm. It should be stitched with HDPE thread. Geotextile must be anchored within anchor trench including excavation of trench				

	and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, stitching, wastage complete. Measurement will be made as per finished surface area. Geotextile in the anchor trench will be taken in measurement.				
	As per M.R	Sqm	43942.88	150.00	6591432.05
2	Providing and fixing Complete Gas Vent as per requirement including Excavation, providing & laying of 50mm metal and Gol Bajari, providing and placing HDPE Pipe 110mm OD with bend and flanges, providing and placing PCC (M-10) grade concrete and RCC Hume Pipe of 300mm OD and providing Soil and Betonite seal with Geotextile seal cover etc complete as per position and detailed drawing.(Detailed Execution steps & Methods of construction are enclosed with Tender Documents)				
	As per M.R	Sqm	17.00	9150.00	155550.00
			Total Amount		**6746982.05**

Table 59: Civil Work for M.S.W Closure for Cell 2 (Part III)

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
	Providing and spreading Gravel at the site for Filter Layer to the required lines, curves, grade and section, including conveying, as directed. Material made up of diameter not less than 2.5 mm for Gravel and not more than 4.0 mm to function as a passage for the leachate to be collected in the pipe. The hydraulic conductivity of the layer should be no less than 1 x 10.0 cm/sec and it should be free from debris/soil.				
1	As Per Schedule of rates, Varanasi	Cum	16015.83	833.00	13341183.63
	Providing and spreading Protective Soil over Landfill Base, sand filter layer & Bund slope at site, to the required lines, curves, grade and section, for a consolidated thickness of 300 mm, including conveying etc. complete.				
2	As Per Schedule of rates, Varanasi	Cum	48295.61	190.00	9176165.97
3	Total civil work for surface drains				
	Excavation in Earth, Soil of all types, for Collection Chambers, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for the Chambers and necessary backfilling, ramming, watering including shoring and stutting etc. complete.				
(a)	As Per Schedule of rates, Varanasi	Cum	949.84	30.00	28495.32
	Providing Second class Burnt Brick Masonry for Collection Chambers, with conventional/I.S. type bricks in cement mortor 1:6, including bailing out water, striking joints on unexposed faces, raking out joints on exposed faces & watering, complete.				
(b)	As Per Schedule of rates, Varanasi	Cum	280.95	1280.00	359610.2528
	Providing Internal Cement Plaster 20 mm thick for Collection Chambers, in a single coat in cement mortor 1:4, without neeru finish to concrete or brick surface, in all positions including scaffolding and curing complete.				
(c)	As Per Schedule of rates, Varanasi	Sqm	2407.88	42.00	101130.9978
	Grassing with 'Doob' grass including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing including supplying good earth if needed (the good earth shall be paid for separately) In rows 15 cm apart in either direction.				
4	As Per Schedule of rates, Varanasi	100 Sqm	502.92	128.00	64373.296
				Total Amount	**23070959.47**

Table 60: Geotechnical Work for M.S.W Closure for cell 2 (Part-IV)

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	Supply & install non-woven geotextile (GT) of 350 g/M^2 made of Polypropylene of TC Mirafi (USA) / Polyfelt (Austria) / Synthetic Industries (USA) / Amoco Fabrics, (USA) Nauefaser Technik GSE (Germany) make or from its regional offices as per details given in General Specifications, spreading on the filter (Gol Bajari) layer or Geomembrane as per direction of the Engineer without damaging the GT or GM. The Geotextile must be placed along the slope from top to bottom with an overlap of 100mm. It should be stitched with HDPE thread. Geotextile must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, stitching, wastage complete. Measurement will be made as per finished surface area. Geotextile in the anchor trench will be taken in measurement.				
	As per M.R	Sqm	47133.38	150.00	7070006.91

2	Providing and fixing Complete Gas Vent as per requirement including Excavation, providing & laying of 50mm metal and Gol Bajari, providing and placing HDPE Pipe 110mm OD with bend and flanges, providing and placing PCC (M-10) grade concrete and RCC Hume Pipe of 300mm OD and providing Soil and Betonite seal with Geotextile seal cover etc complete as per position and detailed drawing.(Detailed Execution steps & Methods of construction are enclosed with Tender Documents)				
	As per M.R	Sqm	20.00	9150.00	183000.00
				Total Amount	**7253006.91**

Table 61: Civil Work Covering Of Waste With 600mm Compacted Soil, Alternative - A

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	**Cutting, dozing and spreading** of M.S. waste as well as natural ground with the help of Dozer or any other suitable machinery/equipment and compacting the M.S.W./soil with the help of Dozer it self up to required line and level show in drawing. Excess of waste cut will be shifted within the plot as per instruction given by Engineer-In-Charge. The newly filled area must also be compacted with the dozer upto required compaction etc. complete.				
	Ref: Schedule of rates, Varanasi	Cum	14730.55	37.50	**552395.60**
2	Providing and spreading **Protective soil , 600mm thk.** over the waste to the required lines, curves, grade and section, for a consolidated thickness of 600mm, including conveying etc. complete.				
	Ref: Schedule of rates, Varanasi	Cum	35686.73	190.00	**6780479.46**
3	Grassing with 'Doob' grass including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing including supplying good earth if needed (the good earth shall be paid for separately) In rows 15 cm apart in either direction.				
	As Per Schedule of rates, Varanasi	100 Sqm	619.99	128.00	**79358.34**
				Total Amount	**7412233.39**

Table 62: Civil Work for waste with proper closure, Alternative - B

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	**Cutting, dozing and spreading** of M.S. waste as well as natural ground with the help of Dozer or any other suitable machinery/equipment and compacting the M.S.W./soil with the help of Dozer it self up to required line and level show in drawing. Excess of waste cut will be shifted within the plot as per instruction given by Engineer-In-Charge. The newly filled area must also be compacted with the dozer upto required compaction etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	6332.38	37.50	**237464.06**
2	Providing and spreading **Protective soil , 450mm thk.** over the waste to the required lines, curves, grade and section, for a consolidated thickness of 600mm, including conveying etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	4007.49	190.00	**761423.33**
3	Providing and spreading **Gravel - 200mm thk** at the site for Filter Layer to the required lines, curves, grade and section, including conveying, as directed. Material made up of diameter not less than 2.5 mm for Gravel and not more than 4.0 mm to function as a passage for the leachate to be collected in the pipe. The hydraulic conductivity of the layer should be no less than 1 x 10.0 cm/sec and it should be free from debris/soil.				
	As Per Schedule of rates, Varanasi	Cum	1781.11	833.00	**1483662.298**
4	Providing & Laying **200MM thick Dry Rubble Soling** over slopes in 1:4 cement sand mortar, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
	As Per Schedule of rates, Varanasi	Cum	758.11	1504.00	**1140204.06**
5	Grassing with **'Doob' grass** including watering and maintenance of the lawn for 30 days or more till the grass forms a thick lawn free from weeds and fit for mowing including supplying good earth if needed (the good earth shall be paid for separately) In rows 15 cm apart in either direction.				
	As Per Schedule of rates, Varanasi	100 Sqm	54.65	128.00	**6995.2**
6	**Retaining wall**				

(a)	Excavation in Earth , soil of all types, including removing the excavated material & stacking and spreading as directed, dewatering, preparing the bed for Landfill and necessary backfilling, ramming, watering including shoring and strutting etc. complete.				
	As Per Schedule of rates, Varanasi	Cum	1776.04	30.00	**53281.19**
(b)	Providing and laying in situ 1:2:4 lime concrete, with trap/granite/quartzite/gneiss broken stone aggregate for foundation including bailing out water form work, compacting and curing complete.				
	As Per Schedule of rates, Varanasi	Cum	44.40	605.00	**26862.60**
(c)	Providing & Laying 300MM thick Dry Rubble Soling at base in 1:4 cement sand mortar, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
	As Per Schedule of rates, Varanasi	Cum	266.41	1504.00	**400674.53**
(d)	Providing & Laying in site Cement Concrete in 1:5:10 for Storm Water Gutter, of trap/granite/gneiss metal for foundation and bedding including bailing out water, formwork, compacting curing complete.				
	As Per Schedule of rates, Varanasi	Cum	88.80	1080.00	**95906.14**
(e)	Providing Plum Concrete in ratio 1:3:6, with cement concrete and stone boulders not more than 150mm equally for retaining wall including bailing out water, formwork, compacting curing complete.				
	As Per Schedule of rates, Varanasi	Cum	1933.59	1292.00	**2498200.22**
				Total Amount	**6704673.623**

Table 63: Geotechnical Work for waste with proper closure, Alternative - B

Sr. No.	Description of Item	Unit	Qty.	Rates (Rs.)	Amount (Rs.)
1	Supply & install non-woven geotextile (GT) of 350 g/M^2 made of Polypropylene of TC Mirafi (USA) / Polyfelt (Austria) / Synthetic Industries (USA) / Amoco Fabrics, (USA) Nauefaser Technik GSE (Germany) make or from its regional offices as per details given in General Specifications, spreading on the filter (Gol Bajari) layer or Geomembrane as per direction of the Engineer without damaging the GT or GM. The Geotextile must be placed along the slope from top to bottom with an overlap of 100mm. It should be stitched with HDPE thread. Geotextile must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, stitching, wastage complete. Measurement will be made as per finished surface area. Geotextile in the anchor trench will be taken in measurement.				
	As per M.R	Sqm	8905.54	150.00	**1335830.40**
2	Supply & install 1.0 mm thk HDPE smooth Geomembrane Liner by Blown/Flat die cast process as per list of companies approved in the detailed specification, laying, anchoring in trench, seaming, testing complete as given in General Specification complete to form an impervious barrier as shown in drawings and as per the Engineer's directions. Minimum width of the Liner shall be 5M. Geomembrane must be anchored within anchor trench including excavation of trench and backfilling, compaction complete at top and bottom portion. Rate to include the necessary lap for jointing, wastage, testing and extrusion rods complete. Measurement will be made as per finished surface area. Liner in the anchor trench will be taken in measurement.				
	As M.R	Sqm	8905.54	250.00	**2226384.00**
3	Providing and fixing Complete Gas Vent as per requirement including Excavation, providing & laying of 50mm metal and Gol Bajari, providing and placing HDPE Pipe 110mm OD with bend and flanges, providing and placing PCC (M-10) grade concrete and RCC Hume Pipe of 300mm OD and providing Soil and Betonite seal with Geotextile seal cover etc complete as per position and detailed drawing.(Detailed Execution steps & Methods of construction are enclosed with Tender Documents)				
	As per M.R	No	8.00	9150	**73200**
			Total Amount		**3635414.40**

Table 64: Rate Analysis for Lifting & Transportation Of Waste- Alternative - C

A .Calculation of volume of waste a person can carry		
Weight, a person can carry per trip (kg) =	20	(assumption)
Density of waste before compaction (kg/m3) =	600	
Volume (m3) = 20/600	0.03	
Assuming 15 min for 1 trip		
Therefore, 4 trips in a hour & assuming 6 hrs. working a day		
No. of trips a person can make in a day = 4 X 6	24	
Volume of waste a person can carry per day (m3) =	0.8	

Calculation of No. of labours required for lifting of waste from following locations

Sr. No.	Location	Volume of waste	No. of labours required
		(m3)	
1	Naya ghat	800.00	1000.00
2	Pralhad ghat	486.00	607.50
3	Sakka ghat	756.00	945.00
		480.00	600.00
4	Teliyanala ghat	640.00	800.00
		1500.00	1875.00
		1050.00	1312.50
		1380.00	1725.00
5	Shailpuli Jharka Pokhri	990.00	1237.50
		8082.00	**10102.50**

Cost of per labour as per Schedule of Rates, Varanasi	75.00	
Cost of lifting of waste per cum =	93.75	
Cost of labour for lifting of 8082 cum =	**757687.5**	
B. Site is within 5 kms from the location		
Transportation Cost for to & fro i.e. for a distance of 5 X 2 = 10 kms		
Therefore, transportation cost for 10 kms per cum (As per Schedule of Rates, Varanasi)	98.85	
Total volume of waste to be transported (Cum) = 8082*2 =	16164.00	
Transportation cost for 16164 cum of waste for 10 kms	**1597811.4**	
After compaction of waste, the area will be 75 m X 75 m X 1.5 m		
This compacted waste should be covered using 600mm compacted soil		
Quantity of soil required for covering this area (Cum) = 75 X 75 X 0.6 =		3375
Cost of soil as per Schedule of Rates, Varanasi, per cum =		190
Therefore, Cost of soil for covering 75 m X 75 m X 0.6 m =		**641250.00**
Total cost of Alternative 3 =	**2996748.90**	

Chapter 6 INSTITUTIONAL ASPECTS & CAPACITY BUILDING

The subject of solid waste management has remained neglected for the past several decades with the result that the level of service is highly inadequate and inefficient. For improving the solid waste management services it is essential to adopt modern methods of waste management, have a proper choice of technology, which can work in the given area successfully. Simultaneously, measures must be taken for institutional strengthening and internal capacity building so that the efforts made can be sustained over a period of time and the system put in place can be well managed. Institutional strengthening can be done by adequately decentralizing the administration, delegating adequate powers at the decentralized level, by inducting professionals into the administration and providing adequate training to the existing staff. It will also be necessary to fix work norms for the work force as well as for supervisory staff and the output expected from the vehicles and machinery utilized. NGO/private sector participation also needs to be encouraged to make the service competitive and efficient.

6.1 Decentralization of Administration

In the city of Varanasi, the SWM services can be performed effectively only if its administration is adequately decentralized at the zone and ward level.

The SWM functions are proposed to be decentralized as under:-

6.1.1 Ward level administration

The city of Varanasi has 90 small wards which cannot independently function as administrative units. Therefore, the 14 sanitation wards created by the corporation could function as ward level office for a group of wards each. This ward level office need to be strengthened administratively and professionally. The ward level administration should be fully responsible for ensuring storage of segregated waste at source, primary collection of waste, street sweeping and taking the waste to bulk community waste storage sites, clearing debris and cleaning surface drains and public spaces. The cleaning of each street, lane, by-lane, markets and public space should be regularly supervised by the ward-level supervisors. Qualified supervisors having a diploma of sanitary inspectors should be appointed as a ward level supervisor per 50000population and he could be designated as sanitary sub inspector. He should work under a sanitary inspector who should continue to be in charge of the existing sanitation ward. By doing his the sanitary inspector's hands will be strengthened by two qualified sanitary sub-inspectors to carry out the duties effectively.

6.1.2 Zone level administration

There are 5 zones in the city. The zonal offices should effectively supervise and

support the work of ward level administration. It should take up the work of construction and upkeep of flooring under the waste storage depot and supervise the transportation of waste from each ward to the respective transfer stations. The zonal officer should be assisted by an assistant engineer preferably an environmental engineer and should have a sanitary officer/chief sanitary inspector as a person responsible to look after the work of sanitation at the zonal level.

6.1.3 City level administration

The city level administration should supervise and support the zonal level administration. The central SWM Department should be responsible for upkeep of vehicles, construction of transfer station and monitoring the processing plants, and disposal sites as and when commissioned by private operators to ensure that they are functioning in an environmentally acceptable manner.

The central SWM department should also be responsible for the procurement of vehicles, equipment, and land for processing and disposal of waste. As a Head Office it should take policy decisions and co-ordinate the activities of all the zones and the wards and be answerable to the municipal commissioner and elected body for the efficient functioning of the department. It should look after the recruitment of manpower, human resources development, training etc.

6.2 Delegation of Powers

Authority and responsibility should go hand in hand. For fixing accountability there should be adequate delegation of fiscal and disciplinary powers to the officers and the supervisory staff responsible for managing solid waste and carrying out all day-to-day functions smoothly.

The Head of the SWM department should also have the power to punish subordinates including supervisory staff. Adequate in-built checks may be introduced to ensure that the delegated powers are not misused.

6.3 Induction of Environmental/Public Health Engineers

The subject of solid waste management, so far being handled by Health Officers (who are medical doctors), and now needs to be handled by environmental engineers or public health engineers with the support of mechanical/automobile engineers to handle the workshop facilities. Qualified engineers should, therefore, be inducted as under.

i. Public Health/Environmental Engineer of the level of Executive Engineer to head the SWM department.
ii. Public Health/Environmental Engineers of the level of Asst Executive Engineer per 5.0 lacs population.

iii. Public Health/Environmental Engineers of the level of Assistant Engineer per Zone (2.5 lacs population.)
iv. Qualified Sanitation Diploma holder/Sanitation Officer @ 1 S.O. per Zone.
v. Qualified Sanitation Diploma holder Sanitary Inspector (S.I.) @ 1 S.I. per every sanitation ward.
vi. Qualified sanitation diploma holder Sanitary Sub-inspector @ 2 per sanitation ward.

6.3.1 Need of manpower

Table 65: Professionals and supervisors

Designation of Post	No. of Post Required	Existing Posts	Shortfalls/surplus
Executive Engineer	1	0	1
Assistant Executive Engineers	2	0	2
Assistant Engineers	4	0	4
Sanitary Officer/CSI	5	0	5
Sanitary Inspectors	14	12	2
Sub Inspectors	28	0	28
Supervisors	0	64	64 surplus
Total	**54**	**76**	**24 surplus**

⇒ **Note. As and when the supervisors retire or qualify the post of sanitary sub inspectors maybe filled and the post of supervisors may be gradually abolished.**

Table 66: Sanitation workers, drivers, etc.

Designation of Post	No. of Posts					
	Sanitation Workers			Drivers		
	Requirement	Existing	Shortfall/ Surplus	Requirement	Existing	Shortfall/ Surplus
Sanitation workers for primary collection of waste from households, shops and establishments	1060 (on contract not to count in staff)	0	- 1060 (to be taken part time on contract	0	0	0
Sanitation workers for sweeping of streets as per the yardstick	1650	1650	0	0	0	0
Drivers and labour for dumper placer machines	30	30	0	30	30	0
Sanitation workers/drivers for hoppers	20	20	0	20	20	0
Sanitation workers/drivers for skip lifter machines	3	3	0	3	3	0
Sanitation workers/drivers on 6 hotel waste collection vans @ 2/1 per van	To be done on contract					
Sanitation workers/drivers on 4 garden waste van, @ 2/1 per vehicle	To be done on contract					
Sanitation workers and drivers for large hauling vehicles at the transfer stations	19	19	0	19	3	-16
Sanitation workers at two transfer stations	8	8	0	0	0	0
Sub-total	1730	1730	0	72	56	-16
Weekly off relievers @ 17% for round the year service	288	288	0	12	0	-12
Total	**2018**	**2018**	**0**	**84**	**56**	**-28**

Note: More than 700 sanitation workers presently used for transportation of waste can become surplus by changing the system to a containerized system. This surplus will meet the short fall of drivers and supervisory staff.

6.4 Human Resources Development

Human resources development is very essential for internal capacity building for any organization. Training, motivation, incentives for outstanding service and disincentives for those who fail to perform are essential for human resources development.

Concerted efforts should be made by the Municipal Corporation to inculcate among its officers and staff a sense of pride in the work they do and to motivate them to perform and give their optimum output to improve the level of services of the city and the image of the Municipal Corporation.

Training

- **Special Training to Unqualified Staff**

  Unqualified supervisory staff should be given in service training to qualify for supervising sanitation works.

- **Refresher Courses for Supervisory Staff**

  Refresher courses should be conducted for the supervisory staff at least every 5 years, or they should be sent for training to get an exposure to advance in this field.

6.5 Work Norms

Norms of Work for Street Sweepers

The sweepers may be assigned "Pin point" individual work assignments according to the density of the area to be swept. The yardsticks given earlier may be adopted.

The norms of work for the supervisors may also be prescribed and monitored by the Municipal Corporation, for the extent of sweeping areas and the number of garbage collection points to be inspected each day by the various levels of supervisors and inspection of processing and disposal sites etc. to ensure adequate output of the supervisory staff.

All Supervisory Officers right from sanitary sub-inspectors to Health Officer and Engineer in-charge of SWM department must remain on the field for 4 hours in the morning between the time of street sweeping and lunch break. The timings for the middle level supervisor could be from 7.00 a.m. to 11.00 a.m. and for senior levels from 8.00 a.m. to 12.00 noon or 8.30 to 12.30 in the morning. The junior level supervisors should supervise there till the end of the working hours of the street sweepers and transport staff. This supervision will have a direct impact on the quality of service.

For capacity building of the department, senior officials should be frequently exposed to developments taking place in various parts of the State and country by sending them out on city visits and to attend seminars, workshops and training courses. They should also be involved in all decision making processes.

6.6 The Entire Administration of SWM Department to be under One Umbrella

With a view to avoid the problems of lack of coordination and passing of responsibility to others, it is necessary to have one person exclusively in charge of SWM in the city. The overall control in relation to collection, transportation, processing and disposal of all waste, including workshop facilities, should lie with him. He should also be responsible for the cleaning of open drains under 24" depth, collection of silt, construction waste and debris and vehicle deployment and maintenance. This work should not be left to the Engineering Department, which should however continue to be responsible for the removal and transportation of silt from the underground drains, storm water drains or surface drains exceeding 24" depth, and the left over waste material from their Engineering and major road works.

6.7 Inter-Departmental Co-ordination

Since the SWM department depends greatly upon the support of various departments of the Municipal Corporation, more particularly the Engineering department, the Municipal Commissioner may hold regular monthly co-ordination meetings to sort out problems faced by the SWM department such as expeditious repairs of roads, drains, water-supply pipe-lines etc. which cause hindrance to street and city cleaning. The reinstatement of roads dug up by utility services should also be given priority.

The procurement procedures for the SWM equipment also need to be expedited and simplified in such meetings. A Rate-contract system should replace time consuming tendering procedures.

There should be an Apex Committee comprised of representatives of various utility services, headed by the Municipal Commissioner to co-ordinate the laying of underground services in the city by various utilities and the reinstatement of the roads as soon as the underground services are laid. The Apex Committee should ensure that repeated digging of road is avoided for laying of services by various utilities at time. The works to be carried out by various utilities on a particular road should be coordinated to prevent frequent digging of roads.

Laying and maintaining of services in slums, provision of public health engineering services and water supply for public toilets and road construction in the slums to improve overall health and sanitation in the city may also be regularly reviewed in the

co-ordination committee meetings.

6.8 Encouragement to NGOs and Waste collector Co-operatives

NGOs may be fully involved in creating public awareness and encouraging public participation in SWM planning and practice.

The Municipal Corporation may also encourage NGOs or co-operative of rag pickers to enter this field and organize rag pickers in doorstep collection of waste and provide them an opportunity to improve their working conditions and income. The Municipal Corporation can give incentives to NGOs in their effort of organizing rag pickers in primary collection of recyclable and/or organic waste, and provide financial and logistic support to the extent possible.

6.9 NGO/Private Sector Participation

SWM services are highly labour intensive on account of increased wage structure of the Government and municipal employees this service is becoming more and more expensive. Besides, the efficiency of the labour force employed in the Municipal Corporation is far from satisfactory. High wage structure and inefficiency of the work force results into steep rise in the cost of service and yet the people at large are not satisfied with the level of service being provided by the Municipal Corporation. Efforts to increase the efficiency by H.R.D. and institutional strengthening will, to some extent improve the performance but they may not be enough. It is, therefore, necessary that the Municipal Corporation seriously consider augmenting NGO/private sector participation in solid waste management.

Private sector participation or public private partnerships may be considered by Municipal Corporation keeping in mind the provisions of the Contract Labour (Regulation and Abolition) Act 1970 of the Government of India under which state governments can prohibit contracting out the services already being provided by the Municipal Corporation. Therefore, while considering any measure of privatization it is necessary to keep in mind the provisions of the above law, the directions that may have been issued by the state government under this law in those areas which are not prohibited and where Municipal Corporation is not currently providing a service. This will check growth in the establishment costs, bring in economy in expenditure and introduce an element of healthy competition between the private sector and the public sector in solid waste management services. There should be a right mix of private sector and public sector participation to ensure that there is no exploitation of labour as well as of the management.

NGO/private sector participation can, therefore, be considered in newly developed areas, under-served areas and particularly in areas where Municipal Corporation have not been providing service. Some examples are given below:

NGO/private participation is recommended in the areas of door to door collection of domestic waste, door to door collection of commercial waste, door to door collection of hospital waste, hotel waste, construction waste, and yard waste, and in the area of awareness and creating public participation. The private sector may also be brought in for the operation and maintenance of compost plants and other treatment plants and O& M of engineered landfill facility.

In such an arrangement the corporation will be responsible for providing services up to the transportation of waste to transfer station and the private party can be given a concession contract for construction and operation of transfer station, treatment and disposal facility.

Major repairs and maintenance of vehicles at a private garage may also be considered seriously.

6.10 Incentives To The NGOs/Private Sector

Solid waste management, processing and disposal are an area where the private sector has still not shown much interest. The private sector has, therefore, to be given some incentives by way of long term contract, assured supply of garbage at the plant site, lease of land at nominal rates for entering this field.

NGO as well as Private sector participation may be encouraged in such a way that it does not affect the interests of the existing labour; it does not violate the provisions of the above law, does not exploit the private labour and yet reduces the burden of the Municipal Corporation. This will substantially help in improving the quality of service of the Municipal Corporation, effect economy in expenditure and also give scope to the private sector to enter the waste management market.

Chapter 7 PROMOTION OF RRR & CREATION OF PUBLIC AWARENESS

7.1 Reduce, Re-use and Re-cycle (RRR)

Everyone is concerned with the growing problems of waste disposal in urban areas with the scarce availability of land for processing and disposal of waste and environmental remediation measures becoming ever more expensive. It is therefore necessary to not only think about effective ways and means to process and dispose of the waste that we generate each day, it is also essential to seriously consider how to avoid or reduce the generation of waste in the first place and to consider ways to re-use and recycle the waste, so that the least quantity of waste needs to be processed and disposed of. This requires a very effective public awareness campaign coupled with commitment by industries and the efforts of decision-makers at all levels.

While the quantity of food waste generated per capita has remained almost static, the quantity of packaging waste material and non-bio-degradable waste is going up alarmingly every year. This increases the burden on corporation to deal with the problem of non-biodegradable and non-recyclable components of waste landing up at processing and disposal sites.

The following measures are therefore proposed to Reduce, Re-use and Recycle waste:

All manufacturers producing a variety of domestic and non-domestic products, food as well as non-food should be persuaded to seriously Endeavour to use re-usable packaging materials so that after the delivery of goods, the packaging materials could be collected back and used over and over again. They could also consider minimizing or avoiding use of unnecessary packaging materials by innovative methods.

- Incentives and product discount should be given to consumers for the return of packaging or bottling materials in good condition, to the waste producers or retailers to promote re-use.
- The cost of packed articles and article without the packaging material could be kept different with a choice to the consumers to take the article without the packaging material at low cost.
- The present trend towards one-time-use packaging needs to be reversed. Multi-use bottling practices need to be re-introduced.
- Hard-to-recycle packaging like PET bottles metalised plastic films and multi-film packs must be phased out unless producers take responsibility for their recall and recycling or re-use.

7.1.1 Re-Use

One person's waste can be useful material for others. Efforts should therefore be made to encourage collection of such re-usable material through waste collectors, waste producers, NGOs and private sector instead of allowing reusable waste to land up on the disposal sites. Bottles, cans, tins, drums and cartons can be reused.

The Eco-surcharge so levied could be passed on to the Technology Mission proposed in this report to channelise these funds to Municipal Corporation for improving their Waste Management practices.

7.1.2 Re-Cycling

In the era of excessive packaging materials being used, a lot of recyclable waste material is generated. All-out efforts are necessary to retrieve recyclable material as has been recommended in the report and fed to the recycling industries.

7.2 Public participation

Public participation is the key to success in these efforts. Information, Education and Communication (IEC) mechanisms should be used to ensure effective public co-operation.

7.3 Public Information, Education, Communication and Awareness Programs

For the successful implementation of any program involving public participation, it is essential to spell out ways in which public participation in hygienic Solid Waste Management (SWM) can be promoted and ensured, hand in hand with Municipal initiatives.

Citizen co-operation is vital for keeping garbage off the streets, especially at the very first stage of keeping biodegradable "wet" kitchen and food wastes unmixed and separate from recyclable "dry" wastes and other hazardous wastes. If the reasons for this are explained, public participation is bound to improve. A series of measures can be taken to bring about a change in public behavior through public awareness campaigns, which could be as under:

7.3.1 Involvement of professional communicators

If messages are not conveyed in the right way, they may not yield the desired results. Professional inputs are necessary in developing a strategy for effective communication. Most large advertising agencies have Social Marketing experts to convey civic messages effectively. They can be contacted at the city level to create suitable messages for various uses, preferably free or at cost as a public service.

7.3.2 Information hot-line

The key to success of any public-education, awareness and motivation program is to provide as many ways as possible for the public to interact, as promptly and conveniently as possible, with policy-makers, to seek clarification of doubts, share ideas or give suggestions which are constructively followed up. A telephone hot line or Post Box number for written communications could be one of the ways to have inputs from members of the public. This need to be manned during working hours (or even later) by polite, responsive and dynamic persons who are well informed, interested in the subject and available at all stated times. These communication channels (one or more) can be set up and monitored by using suitable in-house staff of the corporation.

7.3.3 Use of Cable TV and Cable channels

This is a very powerful medium and can be used to advise citizens not to litter and instead keep two bins for the storage of waste at source, one for biodegradable waste and another for recyclable waste. Citizens may also be advised to cooperate in handing over their waste to the waste collector on a day to day basis as per the collection arrangements and timings prescribed by the municipal corporation. This network can also publicize the contact numbers of the officials for addressing their grievances as regards to solid waste management.

7.3.4 Advertisements in newspapers

Advertisements may be given in local news papers from time to time to create public awareness. Local newspapers can also be requested to start a regular Suggestion Box on the city page to improve solid waste management services in the city. They may also be requested to give coverage to successful initiatives that have overcome such problems in a constructive way.

7.3.5 Use of hoardings/banners

Special Hoardings/banners may be put in the city covering messages seeking public participation. Alternatively, all Municipal-licensed Hoardings should have a space reserved for civic messages. This will add a "socially-aware" image to the advertisers and will not reduce the usefulness of the hoarding to them at all. The messages can be those developed by advertising agents to promote any of the recommendations of this new waste-management policy. The Hoardings should also publicize the hot-line numbers etc.

7.3.6 Issue of handbills

Corporation may get handbills printed with photographs showing the new system of waste management and advise the people to cooperate in making their city clean and healthy. Such handbills could be got prepared from the professionals for

effective delivery of message. Corporation can use newspaper delivery services for distribution of handbills besides distributing the same through health department network.

7.3.7 Display of slides in cinema theatres

Very brief messages may be displayed through cinema slides to educate the citizen for participating in SWM services.

7.3.8 NGO involvement

Many NGOs are committed to improve SWM practices to protect the environment and have been very active in this field. They have also developed good mass-communication skills and education programs for the public. Such NGOs may be persuaded to actively support the new strategies recommended in this report and associate in public awareness campaigns. Those that wish to conduct programs for sections of the public on the new SWM strategies should be encouraged to do so through direct support or through use of Corporation facilities:

7.3.9 Street plays in slums

NGOs may be requested to organize simple street plays through college students and high school students to convey message to handle the SWM effectively by the community. All the slum pockets could be covered by staging street plays to educate the slum dwellers.

7.4 Use of Schools and Colleges

Children are powerful communicators. Parents who do not listen to advice from others will often take their children seriously. Children are idealistic and would like to change their world for better. The municipal corporation may motivate the schools in the city to take out rallies in the morning carrying placards conveying brief messages against littering and storage of waste at source. The strategy should be not just pass through the streets and shout slogans and instead the students may be disbursed in each land and by lane to communicate the message in person to the parents and reassemble after covering lanes from the left and right sides of the main roads and thus cover the whole city. Large number of schools if involved simultaneously would be in a position to cover the city in a very short time and effectively.

7.4.1 Involving commercial sponsors

Firms can be encouraged to adopt certain areas or sponsor cleanliness drives and give awards to those who maintain cleanliness in the selected areas.

The following budget may be allocated for creating public awareness

Table 67: Budget for public awareness

Description of IEC activities	Amount in lakhs
Publicity through local cable network. 10 times a day on alternate day in the first year and twice a week in the subsequent year.	10
Advertisement in all local newspapers 4 times in the first three month to be repeated Twice in a quarter in next 6 months.	10
Distribution of 5 Lakhs pamphlets over a period of one years.	5
Banners. Put 4 banners of 12 ft. x 4 ft in each ward and about 100 banners at strategic market places. Total 400 banners.	2
Cinema slides. Make sets of 10 slides to be displayed for one year	1
Street plays. Organize one street play in every slum/colony through NGOs in one year.	20
Organize rally of students. 8 rallies in a year for two years.	4
Awareness training to municipal staff. Sweepers for 1/2 day, sanitary supervisors for 1 day.	1
Field visits/ exposure visits of the concerned officials of the corporation / other concerned institutions.	15
Miscellaneous expenses in organizing the events.	5
Awareness campaigns through group meetings over a period of one year	5
Special programmes during high pilgrim days	5
Continuous Awareness drive at Ghats/Colonies through NGOs	20.5
Total IEC Budget	**1.035 Crore**

Chapter 8 FINANCIAL ASPECTS

8.1 Municipal Finances

The municipal finances are showing an upward trend in its annual growth as could be seen from the summary of corporation fund for the years 2001-02 to 2005-06 as under.

Table 68: Summary of corporation fund

Item	2001-02	2002-03	2003-04	2004-05	2005-06
	Amount in lakhs Rs.				
Revenue receipts	4019.62	4105.03	4452.57	4206.60	5944.54
Revenue expenditure	4381.67	3844.57	4699.97	4464.42	4649.98
Surplus/Deficit	(362.05)	260.46	(247.40)	(255.82)	1294.56

Details of expenditure on solid waste management in the year 2006-2007 could be seen from the table 31 below.

Table 69: Details of Expenditure

Head of expenditure	Budgetary provision (figures in lakhs)	Actual expenditure (figures in lakhs)
Salaries of sanitation workers	1900	1909
Salaries of contract labour	180	130
Uniforms, etc.	20	18.44
Salaries of transport staff	90	91
Repairs and maintenance	65	59
Tools and equipment	45	44.99
Diesel	150	141
	2450	**2393.43**

It is observed that the municipal corporation is mainly dependant on government grants which accounts for almost 69% of the revenue income. It is observed that the establishment cost of the city is very high. It is as high as 64% of the total revenue expenditure which is alarming as very little amount is left for developmental activities. The current financial position of the municipal corporation could thus be considered unsatisfactory. The corporation, therefore, need to take concerted measures to

improve its financial health.

With the modernization of solid waste management system, the annual expenditure on repairs and maintenance of tools, equipment and vehicles will increase though; there would be a reduction in manpower cost for the operation and maintenance of the modern equipment. The corporation needs to make adequate provision for the maintenance of tools, and fleet of vehicles as well as for their replacement of the tools, equipment and vehicles at the end of their useful life.

Until now the corporation never did scientific disposal of waste and therefore, practically did not spend any amount on treatment and disposal of waste. But now, when it is mandatory to treat and dispose of the waste scientifically, the corporation will have to shell out money towards the tipping fees per tonne of waste to be disposed of at the scientific landfill as soon as it is ready for operation. It is therefore, essential for the municipal corporation to earmark adequate funds for solid waste management hereafter and also provide for an annual increase in the cost on account of population growth and escalation in prices. The corporation needs to set apart a minimum 5% amount towards the repair and maintenance for tools and equipment and 10% to 33% cost of tools and equipment towards their replacement at the end of their useful life and also provide for a minimum of Rs. 200 per MT of waste as a tipping fee for the disposal of at least 30% of the waste rejects (around Rs. 150 lakhs a year depending on the rates that may be finally approved through a contractual mechanism). This minimum amount will have to be set apart each year besides the normal expenditure of fuel and the wages of the staff engaged in solid waste management services.

The requirement of funds for the procurement of tools and equipment as has been recommended in this report and for the closure of old dump sites is shown in the Table 60 below which is followed by a Table 61 showing the requirement of funds for annual repairs and the replacement of the tools, equipment and vehicles at the end of their useful life which is ranging from 3 years to 10 years. This will be a recurring cost besides the normal salaries and allowances and fuel cost for running the fleet of vehicles.

Table 70: Requirement of tools, equipment, vehicles and funds for the procurement of the same as well as for the construction of treatment and disposal facility and remediation of old waste dumps

Sr. No.	Item of Expenditure	Quantity Required	Quantity Existing	Shortfall	Cost per unit in Rs.	Total Expenditure (in Lakhs)
1	Containerised Tricycle for door to door collection of waste with 6 LDPE Containers	800	0	800	10500	84.00
2	Pushcarts with 6 bins for door to door collection of waste from narrow lanes (MS Steel frame with LDPE Containers)	300	0	300	7875	23.63
3	Containerized Tricycles for collecting street sweepings with LDPE Containers	888	0	888	10500	93.24
4	Pushcarts with 6 bins for collecting street sweepings from narrow lanes	484	0	484	7875	38.12
5	Seamless handcarts for drain cleaning	400	400	0	0	0.00
6	Litter bins (40Litre Capacity)	500	0	500	1400	7.00
7	7Cubic metre green containers	150	0	150	57000	85.50
8	3.5Cubic metre green containers	189	65	124	35000	43.40
9	3.5Cubic metre black containers for street sweeping	239	0	239	35000	83.65
10	Dumper Placer Vehicles (10Ton GVW) having twin bin lifting device with hyraulic cylinders and high pressure	27	12	15	1100000	165.00
11	Dumper Placer Vehicles with hyraulic cylinders and high pressure	28	0	28	1100000	308.00
12	4.5Cubic metre skip containers for storing and transporting construction debris	30	0	30	40000	12.00
13	Skip Lifters Machines	3	0	3	1050000	31.50
14	Hopper/Small Pickup Vans	20	22	0	0	0.00
15	Large Hauling Vehicles for Transfer Station (27Cubic Metre)	19	2	17	2275000	386.75
16	Hotel waste collection vans	6	6	0	0	0.00
17	Garden waste collection vans	5	5	0	0	0.00
18	Asphalting of flooring under the containers	577	0	577	13000	75.01

Sr. No.	Item of Expenditure	Quantity Required	Quantity Existing	Shortfall	Cost per unit in Rs.	Total Expenditure (in Lakhs)
19	Construction of Simple Ramp Model Transfer stations with weighing bridge, compactors and washing facility	2	0	2	15209090	304.18
20	Flower composter machine	4	0	4	1500000	60.00
21	Compost Plant of 375MT/Day Capacity with Equipments	1	0	1	130600000	1306.00
22	Upgradation of Maintenance Workshop for repair and maintenance of Vehicles	1	0	1	2500000	25.00
23	Closure of existing open waste dumps	1	0	1	20,749,070	207.49
24	Cost of Landfill Construction including Landfill Equipments	1	0	1	136,298,002	1362.98
Capital Costs						**4702.44**
25	Contingency (3% of Capital Costs in DPR)					141.07
Total Capital Costs						**4843.52**
26	**Cost for establishing project implementation mechanism and for consultancy charges towards project preparation at 0.5% of Total Project Cost**					**24.22**
Project Cost						**4867.736**
Reimbursable						
26	Public Awareness IEC, Training & Capacity Building/ Exposure Visits (details provided in IEC Chapter)					100.000
27	Cost of Preparation of Detailed Project Report (1.5% of Capital Costs in DPR)					70.54
28	Monitoring, Supervision, Project Management Costs (5% of Capital Costs in DPR)					235.12
Total Reimbursable Amount						**405.66**

**** Note:***

1. ***The above rates are inclusive of transportation costs.***
2. ***Cost of commissioning is also included in the cost.***
3. ***These rates are valid for a period of one year.***

Table 71: Annual Requirement of funds for repairs and replacement of tools, equipment and treatment and disposal facility

Sr. No.	Item of Expenditure	Quantity Required	Cost per unit in Rs.	Total Expenditure (in Lakhs)	Annual cost of repair (2007 value) in lakhs	Expected life of equipment and vehicles in years	Proportionate annual cost of replacement in lakhs
1	Containerised Tricycle for door to door collection of waste with 6 LDPE Containers	800	10500	84	4.2	3	28.00
2	Pushcarts with 6 bins for door to door collection of waste from narrow lanes (MS Steel frame with LDPE Containers)	300	7875	23.625	1.18125	3	7.88
3	Containerized Tricycles for collecting street sweepings with LDPE Containers	600	10500	63	3.15	3	21.00
4	Pushcarts with 6 bins for collecting street sweepings from narrow lanes	300	7875	23.625	1.18125	3	7.88
5	Seamless handcarts for drain cleaning	400	3500	14	0.7	3	4.67
6	Litter bins	500	2000	10	0.5	3	3.33
7	7Cubic metre green containers	150	57000	85.5	4.275	5	17.10
8	3.5Cubic metre green containers	189	40000	75.6	3.78	5	15.12
9	3.5Cubic metre black containers for street sweeping	239	35000	83.65	4.1825	5	16.73
10	Dumper Placer Vehicles (10Ton GVW) having twin bin lifting device with hyraulic cylinders and high pressure	39	1100000	429	21.45	8	53.63

11	Dumper Placer Vehicles with hyraulic cylinders and high pressure	28	1100000	308	15.4	8	38.50
12	4.5Cubic metre skip containers for storing and transporting construction debris	30	40000	12	0.6	5	2.40
13	Skip lifters	3	1050000	31.5	1.575	8	3.94
14	Hopper/Small Pickup Vans (1Cubic Metre capacity)	20	200000	40	2	5	8.00
15	Large Hauling Vehicles for transfer station (27 Cubic Metre)	19	2275000	432.25	21.6125	10	43.23
16	Hotel waste collection vans (3 MT)	6	800000	48	2.4	8	6.00
17	Garden waste collection vans	5	900000	45	2.25	8	5.63
18	Asphalting of flooring under the intermediate storage containers	577	13000	75.01	3.7505	5	15.00
19	Transfer stations	2	15209090	304.1818	15.20909	30	10.14
20	Flower compost machine	4	1500000	60	3	10	6.00
21	Upgradation of Maintenance Workshop for repair and maintenance of Vehicles	1	2500000	25	1.25	10	2.50
23	Continuous IEC Activities	1	1000000	10	10	NA	0.00
		Total			**123.64709**		**316.65**
Total Cost of Requirement of funds for Repair, Maintenance and Replacement							**440.30**
Annual Cost of Requirement of funds for Repair and Maintenance in Rs. Crores							**Rs. 1,23,64,709/-**
Proportionate annual cost of replacement of equipment/vehicles							**Rs. 3,16,65,000/-**

Table 72: Operations and management cost

Head of expenditure	Amount (In Rs. Lakhs)
Repair & Maintenance	123.65
Replacement after Useful life	316.65
Fuel Cost	225.00
Salary	1,909.00
Cost of landfill Operations @Rs. 200/-MT	175.20
Total	**2,749.50**

As seen from the table above that annually **Rs. 123.65 lakhs** would be required for repairs and maintenance of the tools, equipment and vehicles. Beside this **Rs. 316.65 lakhs** would have to be set apart towards the sinking fund for the replacement of the vehicles and equipment at the end of their useful life. Besides, a tipping fee @ Rs. 200 per MT for nearly 240 MT per day will have to be paid which will amount to **Rs. 175.20 lakhs** annually. We have not included the cost of operations and management of composting plant as it would be run by the private party.

Above mentioned funds will have to be found each year besides **Rs. 1,909 Lakhs** towards salaries and allowances of the existing staff and **Rs. 225 Lakhs** towards fuel cost. The cost of escalation will have to be added as per the market conditions prevailing at a relevant time.

The corporation will not have to spend on operation and maintenance of door to door collection of waste as it would be done through Public Private Partnerships on cost recovery basis. Private party/NGOs/RWAs shall be responsible for operation and maintenance of services.

8.2 Funding for Capital Expenditure

As per the estimates of the cost of procurement of tools, equipment, vehicles and construction of treatment and disposal facilities, the corporation would need **Rs. 4843.52 Lakhs** to put the entire system in place including the cost of closure of old abandoned and current open dumps. In this provision for IEC activities (1.5% of capital costs), Consultancy services (1.5% of capital costs), Supervision and Management (5% of capital costs) and contingency (3%) has been kept as per the guidelines for the DPR for Solid Waste Management for JNNURM cities. This makes the total requirement of funds as **Rs. 4867.736 Lakhs.**

As the time limit for implementing MSWM Rules 2000 is already over in December, 2003, the corporation, therefore, need to procure all the tools, equipment, vehicles and construct treatment and disposal facility very expeditiously and put the system in place within a period of less than 2 years. The project cost should, therefore, be spread in two equal components of **Rs. 2433.868 Lakhs** in the year 2007 and 2008.

8.3 Cost Sharing under JnNURM

As the City of Varanasi is a one million plus covered under JnNURM scheme, it is entitled to get 50% grants from Government of India, 20% grant from the state government.

Private sector participation has been suggested in areas of construction of transfer station, treatment and disposal facilities. Under such an arrangement the Municipal Corporation will provide the services of door to door collection, street sweeping, secondary storage, transportation of waste up to the transfer station and the private parties will be involved to construct and operate the transfer station, treatment & disposal facilities through contracting mechanism. The private party will contribute 30% of the cost share of Municipal Corporation towards the treatment and disposal facilities and the remaining shall be contributed by Varanasi Municipal Corporation.

Table 73: Cost Sharing Under JnNURM

Total Cost of the project in Rs. Crores	Cost Sharing by Government of India Rs. Crores	Cost sharing by State Government Rs. Crores	Cost sharing by Municipal Corporation Rs. Crores
48.67	**24.335**	**9.734**	**14.601**

8.4 Finance for O & M

Whereas, the municipal corporation may find the financial support under the JnNURM scheme for capital investment; but it will have to find funds for maintaining the services in a sustainable manner and ensure that all the facilities created are maintained effectively and adequate funds are made available for the same.

Solid Waste Management is one of the most essential services and needs to be provided satisfactorily so that health and sanitation is maintained and the environment is well protected. It is an obligatory duty of Municipal Corporation. It cannot escape the responsibility of providing this basic service on the grounds of paucity of funds. The Municipal Corporation has, therefore, to find or raise funds to maintain the minimum level of service recommended in this report in the Chapter on Financial Aspects.

The Municipal Corporation may therefore take the following measures simultaneously to find funds for SWM services:-

8.1.1 Identify priority areas

a. Prioritize the services, which the Municipal Corporation has to provide.

b. Put SWM service in that category as it is an essential service and

obligatory for the Municipal Corporation to perform

c. Put all non-obligatory functions in a separate category of duties which may be performed only after providing adequate funds for satisfactory performance of all essential services

d. Put a ban on wasteful expenditure

8.1.2 Inter-se priority among obligatory services:-

a. Decide the minimum level of service the Municipal Corporation would like to provide in each category of service in a given time frame

b. Estimate the requirement of funds for the same

c. Fix the inter-se priority of the essential service, giving due priority to SWM services

d. Allocate funds for each service

e. Decide the critical area in each service and utilize the funds to optimize the benefit to society

f. Defer the expenditure which can wait

8.1.3 Improve collection efficiency

a. Critically look into the existing efficiency of tax collection and collection of charges, fees and other income sources prescribed by the Municipal Corporation

b. Identify the leakages or lapse in the system

c. Plug the leakages and maximize the efficiency of collection of taxes, charges and fees

d. Take professional or private sector help in this area wherever required

e. Divert the additional funds generated through this effort to the essential services.

8.1.4 Review the existing rate and charges

a. Review the existing rates of taxes and charges vis-à-vis the current cost of services

b. Make sure that citizens are reasonably taxed for the services they receive. The rate of taxes may be suitably increased wherever they are very low to reduce the gap between income and expenditure

c. Rationalize the property tax structure preferably on carpet area or plinth basis rather than a rent-based system

d. Introduce the element of cost recovery for specialized services rendered, particularly where doorstep services are given or non-domestic waste is collected

8.1.5 NGO/private sector participation

a. List out all the SWM activities performed by the Corporation.

b. Identify the areas where NGO/ or private sector participation or contracting out of services is possible,

c. Make a shift in policy. Instead of being a provider, be an enabler of the service, which can be given by the private sector or NGO or co-operative for a price to the people directly, to reduce the burden on the Municipal Corporation. In such areas, carefully monitor the performance of the NGO/Private sector to ensure required levels of service

8.1.6 Review establishment costs

a. Critically review the establishment cost and the job requirement of officers and staff

b. Fix work norms carefully

c. Review manpower needs

d. Reduce surplus staff if any or re-deploy them where needed

e. Effect economy in expenditure in all activities of the Municipal Corporation

All the efforts from A to F will improve financial discipline and put the Municipal Corporation in a comfortable position to find funds for solid waste management services and be in a position to provide a good quality of life and healthy environment to the citizen.

8.5 Cost Recovery through User Fees, Carbon Finance/CDM

The municipal authorities in the country generally do not provide door to door waste collection service and do not levy any charges exclusively for solid waste management as solid waste management services are funded from the general taxes levied by the municipal authorities. Now when door to door collection system is being introduced through private sector participation, it is essential to seriously consider the cost recovery for this personal service rendered. This can be best done by levy of user fees from the beneficiaries by prescribing different rates for different categories of waste generators.
The following rates are suggested.

Table 74: User Fee Rates

Category of beneficiary	Monthly user fee
Low income group households	Rs. 20/month
Households other than low income group	Rs. 30/month
Normal Shops and establishments	Rs. 75 to 200/month
Hotels, large commercial complexes, large institutional buildings	Rate to be levied looking to the quantity of waste generated. (average 300/month)

Municipal Corporation should introduce user fee to meet the cost of service from door step without putting any burden on the municipal corporation. Agreement should be signed with NGOs/Private Parties to collect the amount of user fee as proposed above from households/shops/establishments. The NGO/Private party in turn should be asked to pay a fixed amount to Municipal Corporation per month and wages to the work force directly.

Income from such an arrangement would enable the Municipal Corporation to recover part cost of tools and equipments like tricycles, bins, containers etc., provided by corporation. This effort is likely to generate an income of Rs. 17.7 lakhs per month taking an average sharing of profit at the rate Rs. 10/- per household/shop/establishment per month. This source would thus generate income of Rs. 2 crores per annum.

As composting plant would be operated and managed by the private party, the municipal corporation should negotiate at least 25% of the profit share in lieu of capital investments on construction of compost plants and equipments to be made by the central government/state government and Municipal Corporation. Thus 25% of 99 lakhs (Calculated profit per year) i.e. 24.75 lakhs could be received by the Corporation.

The corporation should further explore to raise finances through CDM route, where as per the estimates of the World Bank experts, 10 USD can be realized per 2 Tonnes of waste per day. Considering 600 tonnes of waste per day in 2006 and 735 tonnes by 2011. An average quantity of waste can be put as 665MT per day for availing of carbon finance at the rate 5 USD per tonne per day. An amount of Rs. 5.00Crores can be realized through CDM route. The municipal corporation can make up a sizeable cost recovery through user fees, selling of compost and Carbon finance. If need be, the corporation can divert more funds from its annual budget for SWM by improving the financial management of the city. The Municipal Corporation could raise the finances from the above three sources as under:-

S.No	Source of Income	Income in Rs. Per annum
1	Share from user fees	212 lakhs
2	Sharing of the profits from compost plant	24.75 lakhs
3	Carbon Finance	500 lakhs
	Total	**736.75 lakhs**

The above income would be sufficient to meet the cost of operation and maintenance of tools and equipments, the cost of tipping fee for the landfill and cost of replacement of the tools and equipment at the end of their useful life which is estimated at 663.44 lakhs.

Financial Support from Govt. of India 12th Finance commission:

The 12th finance commission has allocated funds for improving solid waste management activities in class I cities of India. The city of Varanasi has been allotted Rs. 8,07,63,388 as funds from the this grant through the state government out of this money Rs.1,80,17,748 has been spent. The balance amount of Rs. 6,27,45,640 is available with the corporation and will be spent towards improvement of SWM services during the current year.

Chapter 9 SOCIAL, HEALTH & ENVIRONMENTAL ASPECTS

Inefficient storage, collection, treatment and disposal of waste lead to pollution of ground, water and air which result in creation of breeding grounds for vectors, pasts, rodents, etc., causing public health problems. Proper planning for collection, transportation, treatment and disposal of solid waste are therefore, extremely essential for the protection of environment and health and for the social well being of the people.

The urban poor often residing in informal settlements and slums having very little access or no access to solid waste management services suffer the most on account of improper solid waste management services. Many slum dwellers live close to the landfills in several cities; but fortunately situation in Varanasi is far better and does not require any rehabilitation of people.

The challenges of solid waste management will increase in next ten years on account of rapid growth of the city and its peri-urban areas as well as per capita increase in waste generation. This calls for concerted efforts on the part of administration and all stakeholders to reduce, reuse and recycle the waste.

9.1 Health Issues

Presently, the entire municipal solid waste is haphazardly dumped at several open places since last many years. Waste is unscientifically deposited at various places including canals/river which is causing ground water pollution and air pollution besides giving rise to methane gas emission from the dumps. The existing dump sites are therefore, posing a problem of health and problem to the neighbourhood. This project aims at remediation of the existing heaps of waste by transferring all the heaps at one place and resorting to scientific closure of wastes besides constructing a completely new cell fully lined as per MSWM Rules 2000. This will substantially improve the situation and protect health and environment of the neighbourhood.

9.2 Control of Communicable Diseases

House flies play an important role in the transmission of enteric infections which cause diarrhea and dysentery, disease transmission by house flies is common when waste is not properly handled and more so when it is allowed to decay without any preventive measures. Presence of human excreta in the waste emanating from the slums adds to the problem. All these problems will get mitigated by closure of the existing dumps and construction of the engineered landfill.

9.3 Contamination due to Heavy Metals

Poorly operated disposal sites invariably contaminates ground water with nitrates, heavy metals and other chemicals besides it emanates oxides of sulfur and nitrogen

in the air due to incineration of waste. Construction of engineered landfill and closure of the open dumps would substantially control the situation and stop further contamination of ground water and soil with heavy metals, chemicals, etc.

9.4 Impact of Poor Solid Waste Management

There are many negative impacts that result out of improper solid waste management which are listed below and which are planned to be minimized through improved solid waste management system in the city.

- Uncollected waste often ends up in drains causing blockages which result in flooding and in sanitary conditions.
- Flies, breeds in some constituents of solid waste and they spread diseases.
- Mosquitoes breed in blocked drains and cause malaria, dengue, etc.
- Rats find shelter and food in waste dumps and they spread diseases.
- Open burning of waste causes air pollution.
- Aerosols and dusts can spread fungi and pathogens from uncollected waste.
- Uncollected waste degrades the urban environment and aesthetic of the city.
- Dangerous items like broken glass, needles, health care waste mixed with municipal solid waste pose risk of injury and consequent health problems.
- Several health care items find their way in municipal dumps get recycled without sterilization and cause infection and serious health problems.
- Polluted water i.e. leachate growing from the waste dumps contaminate ground water.
- Liquids and fumes emanate from unauthorized dumping of chemical waste at the dump site cause problems of health.
- Landfill gas escapes in the atmosphere and quite often gets trapped resulting in fires at the landfills.
- Methane gas gives rise to green house gases and leads to climate change.
- Fires often take place at the landfills and cause air pollution in the surrounding areas.

All the above ill effects and adverse impacts are proposed to be controlled by scientifically managing the waste at the treatment plant and disposing of the rejects emanating from the treatment plant at the engineered landfill.

9.4.1 Aesthetic Aspect

Haphazard disposal of waste allover at the landfill, emission of foul odour emanating from the haphazard dump, smoke emanating from burning dumps and very unsightly appearance of the existing dumps will all be controlled by the construction of compost plant and engineered landfill at the existing site and the problems of aesthetic faced today will become a matter of past as soon as the remediation measure is taken for the existing waste lying at the dumping ground.

9.4.2 Environmental Management Plan

Environmental management plan is prepared in order to minimize adverse impact on the environment due to various activities of solid waste management. The following measures are planned to be adopted for the protection of environment.

- The containers and the bins used for collection of biodegradable waste shall be of closed type so that waste is not exposed to open atmosphere.
- Collection of domestic waste shall be organized on a day to day basis (24 x 7) to ensure no putrefaction of organic matter takes place.
- The entire secondary waste storage site shall be covered, put on the paved floor and attended on a day to day basis by hydraulic system avoiding manual and multiple handing of waste.
- The entire workforce engaged in primary collection, transportation, treatment and disposal shall have protective gears such as gumboots, hand gloves, masks, etc., to protect their health.
- All the waste stored in secondary storage bins shall be transferred mechanically in covered vehicles and transported in a covered manner leaving no scope of exposure of waste to the atmosphere.
- Waste collected from secondary waste storage depots shall be taken to scientifically designed transfer stations where waste will be directly transferred into a large hauling vehicle avoiding multiple and manual handling of waste.
- The entire waste brought to the transfer stations shall be transported on a day to day basis in large covered vehicle to the treatment plant.
- All the organic matter shall be treated at a scientifically designed compost plant well protected by a buffer so that it does not pose any problem of health and environment in the neighbourhood.
- The rejects from the treatment plant and inert received from the city shall be scientifically disposed of at the engineered landfill on a day to day basis where waste shall be spread, compacted and covered as per the MSWM Rules 2000 giving no rise to foul odour.
- Regular monitoring carbon monoxide, methane, hydrogen sulphide shall be carried out.
- Open burning of waste shall be prevented and
- Entire area surrounding the treatment plant and disposal site shall have a green cover to protect the environment.

Chapter 10 LEGAL ASPECTS

Solid waste management systems adopted in Indian cities are highly inefficient and outdated, lacking public participation. Overall public apathy is observed in the matter of handling and disposal of municipal waste. A system of throwing garbage on the streets by citizens and local bodies collecting the waste from the streets and disposing of it in the most unhygienic manner is in vogue. These systems can be corrected by taking concerted measures involving the public at large through their active participation in the process, and by corporation performing its duties effectively.

Solid waste management practices can never reach the desired level of efficiency until the public participates and discharges its obligation religiously. The system therefore, can only be improved by modernizing the solid waste management system by the Corporation and ensuring public participation through very serious motivational efforts along with adequate legislative support for taking punitive measures.

For improving solid waste management practices in city, the Supreme Court Committee has given wide ranging recommendations defining the roles and responsibilities of the citizens, NGOs, local bodies, etc. Subsequent to the aforesaid report, the Government of India, Ministry of Environment has notified municipal solid waste (Management & Handling) Rules 2000 under the Environment Protection Act 1986; these rules have clearly laid down the measures to be taken by the municipal corporations as well as smaller urban local bodies. Keeping in view both the above report and the rules it is necessary to incorporate suitable provisions in the state law to ensure public participation and for providing for minimum level of service.

Local law also needs to provide for punishment on the spot to those who do not adhere to the directions given for maintaining appropriate solid waste management system in the city giving adequate power to the corporation to punish the offenders.

The following legal provisions may be incorporated by the State Governments in the law-governing corporation.

10.1 LEGAL PROVISIONS

10.1.1 Duty of occupiers of premises to store solid waste at source of generation

It shall be incumbent on the occupiers of all premises to keep two receptacles, one for the storage of food/organic/bio-degradable waste and another for recyclables and other types of solid wastes generated at the said premises. The domestic hazardous waste shown in Annexure 7, shall however be kept separately in a suitable container as and when such waste is generated.

10.1.2 Duty of occupier not to mix recyclable /non-bio-degradable waste and domestic hazardous waste with food waste etc.

It shall be incumbent on the occupier of any premises to ensure that the recyclable waste as well as domestic hazardous waste generated at the said premises does not get mixed with the food/bio-degradable waste and that they are stored separately.

10.1.3 Duty of Societies/Associations/Management to provide community bins

It shall be incumbent on the management of Co-operative Societies, Associations, Residential and Commercial Complexes, Institutional buildings, markets and the like to provide community bin/bins of appropriate size as may be prescribed by urban Corporation, for the temporary collection of waste other then recyclable waste and hazardous waste, to be stored at their premises for its primary collection by the municipal authorities. A separate community bin may also be provided for the storage of recyclable waste where door to door collection of recyclable waste is not practiced.

10.1.4 Receptacles to be kept in good repair

Receptacles as stated in 3 above shall at all times be kept in good repair and condition and shall be provided in such number and at such places as may be considered adequate and appropriate to contain the waste produced by the citizens supposed to be served by the community bins.

10.1.5 Duty of occupiers to deposit solid waste in community bins

It shall be incumbent on occupiers of all premises for whom community bins have been provided as per 3 above, to cause all segregated domestic waste, trade waste, institutional waste from their respective premises to be deposited in the appropriate community bins.

10.1.6 Duty of Corporation to provide temporary waste storage depots

It shall be incumbent on the corporation to:

Provide and hygienically maintain adequate waste storage depots in the city and place large mobile receptacles at such places for the temporary storage of waste collected from households, shops and establishments as well as from streets and public spaces until the waste is transported to processing and disposal sites.

Make adequate provision for closed containers in various parts of the city for the deposition by citizens of domestic hazardous waste material listed in Annexure 7.

10.1.7 Duty of occupier of households / shops / establishment to hand over the recyclable material / non-bio-degradable waste to the waste collectors / waste purchasers / recyclers

It shall be incumbent on households / shops / establishments to hand over their segregated recyclable waste / Non-bio-degradable waste to waste collectors, waste purchaser or recyclers as may be convenient or as may be notified by the Corporation from time to time. Such waste shall not be disposed of on the street or in municipal bins or open spaces along with the organic/food/bio-degradable waste.

10.1.8 Duty of Corporation to collect waste from community bins and to deposit it at Bulk Community Waste Storage Sites for onward transport

It shall be incumbent for corporation to remove all solid waste deposited in community bins on a daily basis and transfer it to the temporary Waste Storage depots/containers identified in the city or arrange for its expeditious transport to processing or disposal sites.

10.1.9 Duty of Corporation to clean all public streets, open public spaces and slums

It shall be incumbent on corporation to arrange for cleaning of all public streets having habitation on both or either side, and all slums on all days of the year including Sundays and public holidays.

10.1.10 Duty of Corporation to transport the waste stored at the waste storage depot regularly.

It shall be incumbent for the corporation to arrange for the transportation of waste stored at open waste storage depots daily and before the waste storage containers start overflowing places where close containers are placed.

10.1.11 Duty of Corporation to arrange for composting of organic/food/bio-degradable waste and disposal of rejects

It shall be incumbent for the corporation to arrange for the composting of food/organic/bio-degradable wastes produced in the city and dispose of the rejects and non-biodegradable in an environmentally acceptable manner.

10.1.12 Prohibition against littering the street and deposit of solid waste

No person shall litter public streets or public places or deposit or cause or permit to be deposited or thrown upon or along any public street, public place, land belonging to the Corporation or any unoccupied land or on the bank of a water-body any solid waste except in the receptacles specified in 1, 5 and 7 above.

10.1.13 Prohibition against deposition of building rubbish

No person shall deposit or cause or permit to be deposited any building rubbish in or along any street, public place or open land except at a place designated for the purpose or in conformity with conditions laid down by the municipal corporation / municipality.

10.1.14 Prohibition against flow of filthy matters on public places

No owner or occupier of any building or land, shall allow any filthy matter to flow, soak or be thrown there from, or keep or suffer to be kept therein or thereupon, anything which is or can become a nuisance to any person, or negligently suffer any receptacle or place for the deposit of filthy matter or rubbish on his premises to be in such a state as to be offensive or injurious to health.

10.1.15 Prohibition on disposal of carcasses etc.

No person shall deposit or otherwise dispose of the carcass or parts of any dead animal at a place not provided or appointed for this purpose.

10.1.16 Punishment for littering on streets and depositing or throwing any solid waste in contravention of the provisions of this Act.

Whosoever litters the street /or public places or deposits or throws or causes or permits to be deposited or thrown any solid waste or construction debris at any place in contravention of the provisions of this Act or permits the flow of any filthy matters from his premises shall be punished on the spot with a fine not less than Rs.50/- as may be prescribed under the rules framed by the State Govt. from time to time. Such spot fines may be collected by officers authorized by the Municipal Corporation, not below the rank of sanitary inspector. The amount of fine imposed shall be recoverable as arrears of property taxes. The amount of fine shall be kept higher for repeat offences.

Chapter 11 MANAGEMENT INFORMATION SYSTEM

Good management is the key to keep a city clean. This requires collection of critical information which is not just for keeping the records up to-date but used effectively for taking corrective measures as well as proper planning for future. Some information is, therefore, required to be collected to have an overall idea of the prevalent situation, deficiency in the system and likely requirements for the future. Information that highlights the day to day deficiency in the system and can be used in taking corrective measures has to be collected at regular intervals to monitor the services. Computerization of such information helps all the levels to work not harder but smarter and increases the level of job satisfaction.

With the advancement of information technology, Geographic Information System (GIS) could be introduced in large cities and MIS may be integrated in this system. Similarly, there is a need for a citizen interface to seek comments, suggestions etc. on utility services.

Information that needs to be recorded and studied includes relevant information of the department for planning process as well as specific information to know whether every one involved in SWM services is performing his duty well, adequate vehicles are given to the SWM Dept. by the workshop, the vehicles give their optimum output, the repairing and maintenance of vehicles and equipment at the workshop is properly done, the vehicles carrying the waste to the disposal site are optimally utilized, the processing plants are performing well, landfill sites are well managed etc.

The first thing each morning the Municipal Commissioner should see is whether anything unusual or unsatisfactory has happened needing immediate remedial measures. A list of items is given below on which the data should be collected and kept on record for planning purposes and a few performas are designed for monitoring the activities done by various sections of SWM department as under which may be utilized by the local bodies with suitable modifications.

11.1 General Information to be Collected and Updated from Time to Time

1. Area of the city;
2. Population of the city;
3. Decadal growth of population;
4. Number of wards, their area and population;
5. Ward-wise information in regard to :
   - Population density in different wards;
   - No, of Households, shops and Establishments
   - Vegetable/fruit/meat/fish markets
   - Number of Hotels & Restaurants
   - Number Of Hospitals and Nursing Homes

   - Number Of Industries
   - Number Of slum pockets /their population
   - Road length width wise
   - Percentage of area covered with under-Ground sewage system
   - Percentage of area having surface Drains
   - Percentage of area having no drainage Facility
   - Total number of public toilets and Toilet seats.
   - Number Of public urinals
   - Number Of Nuisance spots

11.1.1 General Information on SWM

Waste generation

1. Average quantity of waste produced each day.
2. Seasonal variations in daily waste generation.
3. Total quantity of waste produced annually during last 3 years
4. Breakup of the quantity of wastes generated
   i. Household, shops and establishment waste;
   ii. Vegetable and food market waste;
   iii. Meat, fish and slaughter house waste;
   iv. Construction & demolition waste
   v. Hospital waste
   vi. Industrial waste
5. Average number of carcass removed each day

Staff position

6 Number of sanitation workers deployed in the city for the collection of waste
7 Number of sanitation workers deployed for the transportation of waste
8 Ward wise allocation of sanitation workers
9 Sweeper population ratio in each ward
10 Sweeper road length ratio in each ward
11 Sweeper supervisor ratio in each ward

Waste storage depots

12 Number of sites designated/notified for temporary of waste (Dust bins)
13 Type and size of Dustbin provided in each ward.
14 Ward-wise Quantum of waste generated each day.

Transportation

15 Number Of vehicles available with the local body for the transportation of waste, their type, size and age.
16 Number of trips made by each vehicle in one shift.
17 Number of vehicles used in:
First shift
Second shift &
Third shift
18 Qty. of waste transported in each shift.
19 Total qty. of waste transported each day.
20 Percentage of waste transported each day.

Waste processing and disposal

21 Number of waste processing and disposal sites in the city.
22 Their distances from the Centre of the city.
23 The area of these sites
24 The qty. of waste treated/disposed of at each site
25 The expected life of each land filled site

Financial aspects

26 Operating cost
a. Cost of collection per ton/day
b. Cost of transportation per ton/day
c. Cost of disposal per ton/day
27 Allocation of revenue and Capital budget for SWM vis-à-vis the City Corporation's budget.

11.2 Monitoring of SWM services

For the day-to-day monitoring of SWM services, the following data may be collected, compiled and analyzed.

11.2.1 Daily Reports to Be Sent

Collection of waste

i. Number of sweepers required to report for duty
ii. Number of sweepers actually reporting for duty
iii. Number of sweepers absent
iv. Areas left unattended
v. Arrangements made or proposed to be made for clearing the backlog

Inspection by supervisors for street sweeping & primary collection

i. Number of persons he is required to supervise
ii. Number of persons supervised during the day
iii. Number of cases where performance found satisfactory
iv. Number of cases where performance was not up to the mark
v. Action taken or proposed to be taken
vi. Complaints received and attended

Inspection of cost recovery services

Such as Hotels, Hospitals, commercial streets and offices
i. Number of cost recovery sites under his charge
ii. Number of sites inspected
iii. Deficiencies noticed
iv. Complaints received and attended
v. Action taken or proposed to be taken

Inspection of bulk community waste storage sites

Number of sites in the area under his charge
i. Number sites inspected
ii. Number of sites found well maintained
iii. Number of sites found ill maintained or needing repair or replacement
iv. Action taken
v. Number of unauthorized waste disposal sites or sites identified during field visits
vi. Action taken

Inspection of silt removal sites & building waste disposal sites

i. Number of silt removal sites inspected
ii. Number of sites found satisfactory
iii. Number of sites where silt was found lying outside the man hole or surface drain
iv. Number of construction sites/construction waste disposal sites visited
v. No of sites where construction waste was found disposed of unauthorized
vi. Action taken

Transportation of waste

i. Number and type of vehicles and equipment required to report for duty
ii. Number and type of vehicles and equipment which actually reported for duty
iii. Breakdowns reported during the day and action taken
iv. Number of trips made to the disposal site by each vehicle
v. Number of bins cleared during the day

vi. Number and locations of bins left uncleared and
vii. Arrangements made or proposed to be made for clearing the backlog

Quantities of waste transported

i. Number of vehicles deployed during the day
ii. Number of trips made
iii. Quantity of waste transported
iv. Number of vehicles which did not make adequate trips
v. Number of vehicles which carried less garbage
vi. Action taken or proposed to be taken against defaulters

11.2.2 Weekly Reports

Inspection of processing sites

i. Whether the plant was functional during the week
ii. Whether it received the garbage as prescribed regularly
iii. Whether the site is properly maintained and waste stacked properly
iv. Quantity of Bio organic fertilizer/desired material produced
v. Quantity of produce sold during the week
vi. Quantity of end product in stock
vii. Any irregularity noticed
viii. Action taken

Inspection of waste disposal site

i. Name of the site inspected
ii. Whether all the staff was present on duty during the week
iii. Whether the required machinery was available on site on all the days
iv. Whether the approach road and internal roads are properly made
v. Whether the weigh bridge is functional and properly used
vi. Quantity of waste received at the site on the days during the week
vii. Whether the entire waste was spread, compacted and covered on the same day
viii. Whether communication facilities such as telephone, wireless etc. remained functional during the week
ix. Whether shelter and drinking water facility is adequate
x. Deficiencies noticed
xi. Remedial action taken or proposed to be taken

Record of trip made by transport vehicle at the processing and disposal sites

i. Sr. Number
ii. Date
iii. Vehicle Number
iv. Name of the Driver

v. Arrival time of the vehicle
vi. Trips made including this trip
vii. Waste Source and Route Number
viii. Weight of Waste in M. tones
ix. Deficiencies noticed
x. Action taken

Workshop performance

A
i. Number and percentage of vehicles on road
ii. Number and type of vehicles under repairs at Corporation's or private workshop
iii. Nature of breakdown
iv. Duration of breakdown : under one week, 1-2 weeks, 2-4 weeks and over one month
v. Reasons for delay in repairs
vi. Expected date of vehicle to be back on road

B
i. Number and type of vehicles and equipment required to be given to the SWM Dept. by the workshop or through contractor
ii. No and type of vehicles and equipment actually given
iii. Shortfall if any
iv. Reasons
v. Alternate arrangements made

C Each vehicle should maintain a logbook showing information of its movement and performance as under:

Table 75: Vehicle Log Book

Department:		**Date**
Vehicle Number:		Shift
Driver's name:		
1.	Departure from workshop	
2.	Return to workshop	
3.	Fuel taken in Ltrs.	
4.	Kilometer reading at start of work	
5.	Kilometer reading at the end of work	
6.	Total mileage/kilometer	
7.	Details of trips made and locations covered	
8.	Inspected at point Number ____ by_____ at _____am/PM	
9.	Weight recorded at weighbridge Time in Time out	
Weighbridge Operators' signature		
Driver's Signature	User Dept's Signature.	

Inspection of workshop stores

i. Whether the list of fast moving items is maintained
ii. Whether the list of critical items is maintained
iii. Whether minimum level of stock is maintained

iv. Items found to be out of stock
v. Items found to be over stocked
vi. Deficiencies/ irregularities noticed
vii. Action taken

Computerization of inventory daily with in and out information, balance in stock and economic order quantity would be very useful to keep track of availability and replacement of spares.

11.2.3 DAILY REPORTING

Monitoring of complaints

All complaints regarding SWM services should be registered at the relevant ward office and monitored on day-to-day basis by the ward officer, who should give specific time limit to the Supervisory Staff of Sanitation Department to dispose of the complaints and report compliance. Reviewing the number and type of complaints and timely corrective action taken on each one must form an important part of the weekly review by senior officers.

Recovery of additional cleaning charges

i. Name of the ward
ii. Areas visited
iii. Addl. cleaning charges recovered: Number Amount
From households
From shops
From offices
From other establishment
From road side vendors, eating joints

TOTAL

Cost recoveries/penalties

Ward-wise cost recoveries made every month for a variety of services rendered
Ward-wise penalties or levy of administrative charges from offenders every month

Legal matters

i. Number of cases filed in the courts each month for violation of sanitation laws.
ii. For the effective monitoring of SWM services, the information collected in various performas should be carefully analyzed and corrective measures taken promptly.
iii. There should be route maps and duty charts with each of the supervisory staff, who should check whether work on site is going as per schedule and whether

vehicles and manpower are giving their optimum output. Wireless pagers or other communication networks essential for effective communication and monitoring of services.

11.2.4 Monthly Report

Public Participation

i. Total number of sweepers allotted for door to door waste collection work in each ward.
ii. Number of sweepers getting good response from citizens in the matter of doorstep collection
iii. Number of sweepers not getting response from the public
iv. Percentage of public participation
v. Improvement in this area over the last month

Annexure

ANNEX H Varanasi Action Plan for Water Supply Scheme through AMRUT

NAME OF ULB - VARANASI

Water Supply

1. Assess the Service Level Gap

The first step is to assess the existing situation and service levels gaps for Water Supply (AMRUT Guidelines; para 3 & 6). This will also include existing institutional framework for the sector. AMRUT is focused on improvement in service levels. The zone wise data shall be used in identifying the gaps. These zone-wise gaps will be added to arrive at city level service gaps. While assessing service level gap reply following questions not more than word indicated against each question.

Question: What kind of baseline information is available for water supply system of the city? Detail out the data, information, plans, reports etc related to sector. Is zone wise information available? (75 words)

JalkalVibhagNagarNigam Varanasi maintains water supply of the Varanasi city. Revised CDP & study on NRW as base line information are available. In the revised CDP, formation of CDP committees for policy and technical, health, stress on infrastructural management aspects, revenue enhancement initiatives,expenditure& asset management initiatives, emphasis on PPP projects etc are covered .Yes zone wise information is available.

Question: Have you collected census 2011 data? Are you aware of baseline survey data of MoUD? Have you correlated data from these and other sources? (75 words)

Location of source of drinking water	Total Number of Households	Tapwater from treated source
Total Population- 1198491		
Total H.H	180805	127940
Within the premises	157084	120331
Near the premises	16867	6022
Away	6854	1587
Departmental Data	Total Population 1600000	
H .H	150236	100208

2011 census data is available. Yes. The data is correlated.

What are existing service levels for water supply in the city? What is the coverage of water supply Connections? What is per capita supply of water? How much is the extent of metering? How much is non-revenue water? Provide information in table

Table: Status of Water Supply service levels

Sr. No.	Indicators	Present Status	MOUD Benchmark	Reliability
1	Coverage of water supply connections 100208/180805	67%	100%	D
2	Per capita supply of water 330 MLD/16	206 LPCD	135 LPCD	D
3	Extent of metering of water connections	0 %	100%	A
4	Extent of non-revenue water	58 %	20%	D
5	Quality of water supplied	96 %	100%	D
6	Cost recovery in water supply services	61 %	100%	D
7	Efficiency in collection of water supply related charges	60 %	90%	D

Question: What is the gap in these service levels with regard to benchmarks prescribed by MoUD? (75 words)

As per above table it is clear that gap in service levels is as under:

1. Gap in coverage of water supply is 44.58 %

2. No Gap in Per capita water supply

3. Gap in Metering is 100%.

4. NRW is about 38% which include leakage and free water supply to social gathering festivals along with water supply through stand posts.

5. Gap in Quality of supplied water is 4% as per PHE norms.

6. Gap in Cost recovery is 39% with expenditure on electricity and power.

7. Gap in efficiency of water charges/tax collection is about 30%.

SOURCE OF WATER AND WATER TREATMENT SYSTEM.

Please provide information in 150 words on the above responding to (however not limited to) following questions.

Question: What is the existing source of water? Is it surface water source or under ground water source? What is the capacity of these sources?
Question: Is there any treatment provided to water from these sources? How much water is required to be treated daily? What is the treatment capacity installed in the city?
Question: What per capita water supply in LPCD (liter per capita per day) comes out, if you divide total water supply by the total population.?

There are surface & ground water sources both. About 330 MLD water is supplied to the city and the per capita consumption is 206 with NRW LPCD. The water demand of the city is met by combination of
Surface water(125 MLD) from the Ganga river and
Ground (205 MLD) from 226 tubewells.
Yes, treatment is provided to the water from surface source.For ground water only chlorination is done for disinfection. Installed capacity of treatment is 250 MLD. On the basis of produced water per capita daily supply comes out 206 LPCD whereas after deducting wastage, 330 MLDX38/100= 125.4 MLD NRW Total water availability is 330 MLD – 125.4 MLD NRW = 204.6 MLD/ Total population 1600000 = 127.87 daily per capita supply without NRW.

DISTRIBUTION ZONES

Please provide information in 150 words on the above responding to (however not limited to) following questions.

Question: City is divided in how many zones for water supply ?
The water supply system of Varanasi is divided into 5 ADMINSTRATIVE zones,

Table: Zone Wise Coverage of Households

Question: Provide details of total no of Households (HH) in each zone, no of HH with and without water tap connections in the Table

Zone NAME	Zone No.	Total No. of Households	Households with Water tap Connection	Households without Water tap Connection
ADAMPUR	1	27863 HH	18683 HH	9180 HH
BHELUPUR	2	38685 HH	27222 HH	11463 HH
DASHASHMEDH	3	32435 HH	20542 HH	11893HH

Zone NAME	Zone No.	Total No. of Households	Households with Water tap Connection	Households without Water tap Connection
KOTWALI	4	14974 HH	10421 HH	4453 HH
VARUNA PAR	5	36279 HH	23240 HH	13039 HH
	Total	150236 HH	100208 HH	50028 HH

STORAGE OF WATER

Please provide information in 150 words on the above responding to (however not limited to) following questions.

Question: What is the total water storage capacity in the city? What is capacity of elevated and ground water reservoirs?

The total storage capacity is 79.8 ML. The capacity of elevated & ground water reservoirs is 21.3 ML & 58.5 ML respectively.

Question: In case of surface water, does city need to have ground level reservoirs to store raw treated water?

Yes. In order to introduce 24x7 water supplies, there will be need of ground level reservoir of 100 ML and land is available for construction.

Question: Is water being supplied to consumers through direct pumping or through elevated reservoirs?

Water is being supplied to consumers through elevated reservoirs as well as direct pumping.

Question: Is storage capacity sufficient to meet the cities demand?

Storage capacity demand is 110 ML and availability is 79.9MLcapacity. No, storage capacity is insufficient to meet the cities demand.

DISTRIBUTION NETWORK

Please provide information in 150 words on the above responding to (however not limited to) following questions.

Question: What is the total length of water supply distribution pipe line laid in the city?

The total length water supply distribution pipe line in the city is 858Km.

Question: What is the total road length in the city? Is the pipe lines are laid in all streets? Is the objective of universal coverage of water supply pipe line is achieved?

(a)Total Road Length 1180.046 KM.NO.
(b) No. 322 Km road is not having pipe pine.

(c) No Universal coverage of water supply is not achieved.

Question: What are the kind of pipe materials used in distribution lines?

CI, DI, PVC, AC & GI materials are used in distribution pipe lines.

Question: Provide zone wise details of street length with and without water distribution lines in the Table?

Table: Zone Wise length of distribution network

Zone No.	Total Street Length	Street length with water distribution pipe line	Street length without water distribution pipe line
1	187.72 KM	155 KM	32.72 KM
2	214.525 KM	193 KM	21.525 KM
3	233.325 KM	220 KM	13.325 KM
4	93.635 KM	90 KM	3.635 KM
5	450.841 KM	200 KM	250.841 KM
Total	1180.046 KM	858 KM	322.046 KM

INSTITUTIONAL FRAMEWORK

Please provide information in 150 words on the above responding to (however not limited to) following questions.

Question: Define role and responsibilities in terms of O&M, policy planning, funding, service provision in table

Table: Functions, roles, and responsibilitis

Planning and Design	Construction/ Implementation	O&M
U.P. Jal Nigam and Varanasi Municipal corporation	U.P. Jal Nigam	Varanasi Municipal corporation (VMC)

Question: How city is planning to execute projects ?

Varanasi Nagar Nigam is the owner of the infrastructure and the Jalkal Department is the provider of water and sewerage services in the City while UP Jal Nigam is the parastatal to do the work. On required demand by ULB the U.P Jal Nigam plans, designs & executes the project.

Question: Shall the implementation of project be done by Municipal Corporation or any parastatal body? Please refer para 8.1 of AMRUT guidelines.

Ongoing projects of JnNURM is being executed by UP Jal Nigam parastatal body of ULB. According to para 8.1 of AMRUT guidelines, projects will be executed by state ULBs. As the Jalkal Department has been merged with VMC, therefore, all the projects proposed under AMRUT will be executed by VMC through its Jalkal Department. If requires, resolution may be passed by VNN to engage parastatal agency, UP Jal Nigam for execution of work.

2. Bridge the Gap

Once the gap between the existing Service Levels is computed, based on initiatives undertaken in different ongoing programs and projects, objectives will be developed to bridge the gaps to achieve universal coverage. (AMRUT Guidelines; para 6.2 & 6.3, Annexure-2; Table 2.1). Each of the identified objectives will be evolved from the outcome of assessment and meeting the opportunity to bridge the gap.

Question: List out initiatives undertaken in different ongoing programs and projects to address these gaps. For this provide details of ongoing projects being carried out for sector under different schemes with status and when the existing projects are scheduled to be completed? Provide information in Table

Table: Status of Ongoing/ Sanctioned

S.No.	Name of Project	Scheme Name	Cost	Month of Compilation	Status (as on dd mm 2015)
1	Water supply reorganization priority-1,phase-1	JnNURM	139.79 cr.	Dec.2015	95%
2	Water supply reorganization priority-1,phase-2	JnNURM	110.50 cr.	Mar. 2017	70%
3	Water supply reorganization priority-2(Trans Varuna)	JnNURM	268.36 cr.	Mar. 2017	60%

Question: How much the existing system will able to address the existing gap in water supply system? Will completion of above will improve the coverage of network and collection efficiency? If yes, how much. (100 words)

The existing infrastructure or the infrastructure under development is sufficient to meet the requirements up to year 2021 as far as water source, distribution network, storage and treatment capacity are concerned. Gaps in components connected to delivery of water supply. The primary need is to cover all households with water supply, which is also a goal of AMRUT. After completion of ongoing projects, the coverage will reach 100%; Importantly, in order to deliver services governance reforms are required to reduce the NRW levels to 30%. At the same time cost-recovery has to reach 90%.

Question: Does the city require additional infrastructure to improve the services? What kind of services will be required to fulfill the gap?

Yes. 100% metering, NRW reduction, Complete SCADA system ,skilled and infrastructure development ,online water quality control system, e-governance, strengthening of online billnig/collection system & rejuvenation of treatment works will be required to fulfill the gap which has already been indicated in revised CDP.

Question: How does the city visualize to take the challenge to rejuvenate the projects by changing their orientation, away from expensive asset replacement programs, to focusing on optimum use of existing assets?

A major strength of the water supply system in Varanasi is that three projects under JnNURM are at different stages of implementation and early completion of these projects will lead to achieving the target of universal coverage (100%). Moreover, the per capita water supply is greater than 200 LPCD (norm 135) and the NRW is 58%. According to the standards set by the National Mission for Sustainable Habitat (NMSH) the City of Varanasi is in the red (degraded) category as (i) per capita water supply is more than 200 Lpcd and (ii) extent of NRW is also more than 20%. High level of NRW is a weakness of water supply system as it seriously affects the financial viability and sustainability of water utilities. Reading these two together shows the forward. By reducing NRW to 30 % from current 58%, the VMC will be able to manage with only 200 MLD water, as opposed to 410 MLD at present. Handling of less water (nearly 50%) will lead to huge savings in O&M cost making the water supply system viable and sustainable. Therefore, the challenge is to change the focus of projects, away from expensive asset replacement program, to optimum use of existing assets through rejuvenation. The transformation will occur when water supply is managed and operated by an operator whose role extends from source to tap, including water treatment, and the target is to achieve service delivery to citizens. The reason is that service delivery to citizens is a key goal of the AMRUT Mission and real transformation will only occur when operations (non-investment) contract is given using a PPP model. In such a PPP model, typically, the capital costs of projects will be fully funded by the Centre/State/ULBs/others with the city retaining

the right to set and revise tariffs, as set out in the AMRUT Reforms, say on a telescopic volumetric tariff with adequate protection for the poor.

Question: Has city conducted assessment of Non RevenueWater ?if yes, what is the NRW level? Is city planning to reduce NRW ?

Assessment of NRW has been conducted. NRW level is 58%. Yes, city is planning to reduce NRW.

Question: Based on assessment of existing infrastructure and ongoing / sanctioned projects, calculate existing gaps and estimated demand by 2021 for water supply pipe network, number of household to be provided with tap connections, and required enhancement in capacity of water source/ treatment plant (MLD). Gaps in water supply service levels be provided as per Table

Component	2015			2021	
	Present	Ongoing	Total	Demand	Gap
Source	330 MLD	200 MLD	530 MLD	338 MLD	Surplus
Treatment capacity	250 MLD	100 MLD	350 MLD	338 MLD	Surplus
Elevated Storage capacity+CWR	21.3ML+58ML =79.9ML	80 ML	159.9 ML	112.6 ML	Surplus
Distribution network coverage	1500 K.M.	700 K.M.	2200 K.M.	2410 KM	210 KM

OBJECTIVES

PBased on above, objectives will be developed to bridge the gaps to achieve universal coverage. While developing objectives following question shall be responded so as to arrive at appropriate objective.

Please provide List out objectives to meet the gap in not more than 100 words.

Question: Does each identified objectives will be evolved from the outcome of assessment?

Yes. From the above analysis following objectives emerge: 1. To complete the ongoing projects of JnNURM 2. Improvement in O&M in order to reduce NRW Level through an appropriate management model 3.Rejuvenation and refurbishment of intake works and treatment plant.

Question: Does each objective meet the opportunity to bridge the gap?

Yes, each objective meets the opportunity to bridge the gap

3. Examine Alternatives and Estimate Cost

The objective will lead to explore and examine viable alternatives options available to address these gaps.. These will include out of box approaches. (AMRUT Guidelines; Para 6.4 & 6.8 & 6.9). This will also include review of smart solutions. The cost estimate with broad source of funding will be explored for each. While identifying the possible activities, also examine the ongoing scheme and its solutions including status of completion, coverage and improvement in O&M. Please provide information on the above responding to (however not limited to) following questions.

Question: What are the possible activities and source of funding for meeting out the objectives? (75 words)

1.Complete the ongoing Projects with funds sourced from AMRUT and 14th Finance Commission 2. Improvement in O&M in order to reduce NRW Levels by converging Metering Cost (Rs 67.03 Crore) with Project II of JnNURM where procurement of 2 lakh meters are already proposed. Improvement in O&M through a performance based NRW reduction Project S.No Component Basis Amount in Rs.Cr A Infrastructure improvements 1 Distribution and Feeder Networks Improvements Estimate 79.44 2 Metering existing and providing new house connections Estimate 67.03 3 Connections to High Revenue Customers Estimate 7.78 3 SCADA system with MIS Estimate 2.20 4 Contingencies 3% 4.69 Subtotal 161.14 B Management costs linked to performance 1 General Requirements Estimate e 2.33 2 Management Improvements Estimate 9.61 3 Management fee for NRW reduction for 7 years Estimate 75.33 4 Leak repair and road restoration for 6 years Estimate 43.25 Subtotal 130.52 C Implementation overheads for Jalkal department 1 Contract Management by Jalkal 1.50% 4.37 2 Independent technical auditor 0.3% 0.87 Subtotal 5.24 Total investment required 296.90 Rounding off 3.10 total project cost in RsCrore 300 D. Refurbishment of Intake works and treatment plant 169 (Source - Revised CDP) GRAND TOTAL 469 Crores.

Question: How can the activities be converged with other programme like JICA/ ADB funded projects in the city etc? (100 words)

The activities considered above are conceptualized in synchronization with the use of existing infrastructure created/being created under JnNURM/13TH FINANCE COMMISSION.

Question: What are the options of completing the ongoing activities? (75 words)

Alternative A – Capacity building of Jalkal staff and in-house implementation by Jalkal: This is default option wherein a structured capacity building program can be developed through which the existing Jalkal staff can be trained. Alternative B – Capacity building of UPJN staff and in-house implementation by UPJN: UPJN had been the main implementation organization for all capital works including the recent service improvements undertaken under JnNURM and Ganga Action Plan. Considering their long lasting experience in project implementation, it might be possible for UPJN to undertake implementation of NRW reduction program. Alternative C – Improvement in O&M through a performance based NRW reduction Contract: A performance based NRW reduction contract can be structured for hiring an experienced agency through competitive bidding and entrusted with the task of reducing certain volume of NRW in a given time frame. The contractor can be paid a fee for each cubic meter of NRW reduced and the fee could be linked to achievement of performance with added incentives for higher performance and penalties for under-performance. This contract could be at least for 8 to 10 year duration covering entire city. Alternative D – Improvement in O&M through a Comprehensive Performance based Operating Contract for entire operations of Jalkal: Under this option an experienced water operator can be hired to provide senior specialist managers in the areas of water service delivery, production, network management, NRW control, customer commercial services. The operator would be paid a periodical fixed fee and a variable fee linked to achievement of performance targets. This contract could be of at least 5 year duration. Specifying clear and indisputable targets is often difficult; especially when information about a system's current performance is limited. To address this, during the pre-contract phase the utility should ensure that water quality, pressure and operating efficiency standards that they want to identify in the contract can in fact be enforced.

Question: How to address the bottlenecks in the existing project and lessons learnt during implementation of these projects? (75 words)

Regular efforts will be made to address the following bottlenecks. dispute on land earmarked for WTP, the completion of project is affected. road cutting permission from local authorities as well as NHAI and Forest Department.

Question: What measures may be adopted to recover the O&M costs? (100 words)

By improving service standards and coverage as well as revision of user charges, full O&M costs can be recovered. The O&M cost shall be recovered by: 1. Increasing the coverage of water supply to unserved areas, 2. By increasing user charges 3. By reducing NRW

Question: Will metering system for billing introduced?
Installation of domestic meter has been proposed in JnNURM. Billing will be done by metering.

Question: Whether reduction in O&M cost by addressing NRW levels be applied? (75 words)
Yes, O&M cost will certainly reduce after reduction in NRW.

Question: Does each objective meet the opportunity to bridge the gap?
Yes, objectives have been identified to bridge the current service level gaps

THE ALTERNATIVE ACTIVITIES TO MEET THESE ACTIVITIES BE DEFINED AS PER TABLE

Table: Alternative Activities To Meet Objectives

Sr. No.	Objective	Activities	Financing Source
1	Complete the ongoing Projects	Under JnNURM for water Supply projects namely (i) Priority I phase I of Varanasi (Rs.111.02 Cr)(ii) Priority I Phase-II of CisVaruna Area (Rs.86.10 Cr) physical progress of 90 % and 60% has been achieved respectively. VMC has to come forward in addressing the hurdles being faced by these projects and put all efforts in completing projects in time. As per AMRUT guidelines JnNURM projects which has achieved more than 50% progress till ..... are eligible for funding under AMRUT. Therefore VMC has to move proposals for these projects to MoUD for funding under AMRUT.	AMRUT
2	Improvement in O&M in order to reduce NRW Levels	For improvement in O&M following four implementation alternatives may be considered. Alternative A – Capacity building of Jalkal staff and in-house implementation by Jalkal: This is default option wherein a structured capacity building program can be developed through which the existing Jalkal staff can be trained. Alternative B – Capacity building of UPJN staff and in-house implementation by UPJN: UPJN had been the main implementation organization for all capital works including the recent service improvements undertaken under JnNURM and Ganga Action Plan. Considering their long lasting experience in project implementation, it might be possible for UPJN to undertake implementation of NRW reduction program. Alternative C – Improvement in O&M through a performance based NRW reduction Contract: A performance based NRW reduction contract can be structured for hiring an experienced agency through competitive bidding and entrusted with the task of reducing certain volume of NRW in a given time frame. The contractor can be paid a fee for each cubic meter of NRW reduced and the fee could be linked to achievement of performance with added incentives for higher performance and penalties for under-performance. This contract could be at least for 8 to 10 year duration covering entire city. Alternative D – Improvement in O&M through a Comprehensive Performance based Operating Contract for entire operations of Jalkal: Under this option an experienced water operator can be hired to provide senior specialist managers in the areas of water service delivery, production, network management, NRW control, customer commercial services. The operator would be paid a periodical fixed fee and a variable fee	AMRUT

Sr. No.	Objective	Activities	Financing Source
		linked to achievement of performance targets. This contract could be of at least 5 year duration. Specifying clear and indisputable targets is often difficult; especially when information about a system's current performance is limited. To address this, during the pre-contract phase the utility should ensure that water quality, pressure and operating efficiency standards that they want to identify in the contract can in fact be enforced.	
3	Refurbishment of Intake works and treatment plant	Refurbishment of Intake works and treatment plant	AMRUT

4. Citizen Engagement

ULBs will organize and conduct city level citizen consultation and receive feedback on the suggested alternatives and innovations. Each alternative will be discussed with citizens and activities to be taken up will be prioritized to meet the service level gaps. ULB will prioritize these activities and their scaling up based on the available resources. (AMRUT Guidelines; Para 6.6, 6.7 & 7.2). Please explain following questions in not more than 200 words detailing out the needs, aspirations and wishes of the local people.

Question: Has all stakeholders involved in the consultation?

Yes. All stakeholders is being involved in the consultation. Chopal/ public meeting organized on 14/8/2015, 21/8/2015, 28/8/2015, 04/09/2015, 11/09/2015 and 19/09/2015. Board meeting held on 23/09/2015 and 06/10/2015.

Question: Has ward/ zone level consultations held in the city?

Yes, ward/ zone level consultations is being held in the city, Before submission /execution, activities considered under objectives ward level/ zone level consultations will be held.

Question: Has alternative proposed above are crowd sourced?

No

Question: What is feedback on the suggested alternatives and innovations?

Feedback on the suggested alternatives and innovations are being considered to complete all the ongoing projects on time and the work proposed for future should also be planned in such a way that during the work the hazards faced by citizens must be minimized to a tolerable extent.

Question: Has alternative taken up for discussions are prioritized on the basis of consultations?

Yes, alternatives taken up for discussions are prioritized on the basis of consultations

Question: What methodology adopted for prioritizing the alternatives?

Alternatives have been prioritized based on demand raised through consultation with citizens, officials and parastatal agencies.

5. Prioritize Projects

Based on the citizen engagement, ULB will prioritize these activities and their scaling up based on the available resources to meet the respective objectives. While prioritizing projects, please reply following questions in not more than 200 words.

Question: What are sources of funds?

AMRUT, 14th Finance commission, HRIDAY, State Government Funds,ULB's.

Question: Has projects been converged with other program and schemes?

Yes. The convergence factor has been considered while designing and funding of project.

Question: Has projects been prioritized based on "more with less" approach?

Yes, The projects are being prioritized based on "more with less" approach

Question: Has the universal coverage approach indiated in AMRUT guidelines followed for prioritization of activities?

Yes, Universal coverage approach indicated in AMRUT guidelines has been followed for prioritization of activities

6. Conditionalities

Describe in not more than 300 words the Conditionalities of each project in terms of availability of land, environmental obligation and clearances, required NOC, financial commitment, approval and permission needed to implement the project.

Except ongoing project under JnNURM, activities taken under objectives do not require land and environmental obligation and clearance. So far as financial commitment is concerned, state government and ULB will contribute their respisective share.

7. Resilience

Required approvals will be sought from ULBs and competent authority and resilience factor would be built in to ensure environmentally sustainable water supply scheme. Describe in not more than 300 words regarding resilience built in the proposals.

Yes, Resilience factor would be built in to ensure environmentally sustainable water supply scheme ULB is well known to local topology and bottlenecks of the city. Therefore during the execution of the project considering the area wise status of the city possible changes can be carried out considering the environmentally sustainable water supply and minimized hazards to the citizens. Also the

approval from the competent authority is must to have good control on the works to have sustainable water supply.

8. Financial Plan

Once the activities are finalized and prioritized after consultations, investments both in terms of capital cost and O&M cost has to be estimated. (AMRUT Guidelines; para 6.5) Based on the investment requirements, different sources of finance have to be identified. Financial Plan for the complete life cycle of the prioritized development will be prepared. (AMRUT Guidelines; para 4, 6.6, 6.12, 6.13 & 6.14). The financial plan will include percentage share of different stakeholders (Centre, State and City) including financial convergence with various ongoing projects. While preparing finance plan please reply following questions in not more than 250 words

Question: How the proposed finance plan is structured for transforming and creating infrastructure projects?

As per the guidelines of the AMRUT, the structured plan of the project has been developed.

Question: list of individual projects which is being financed by various stakeholders ?

Presently, JNNURM is financed by following stakeholders:- 1- GOI 33% 2-GoUP 33% 3-ULB 34%

Question: Has financial plan prepared for identified projects based on financial convergence and consultation with funding partners?

Yes, financial plan prepared for identified projects are based on financial convergence and consultation with funding partners. Reduction in non revenue water (NRW) project costing Rs. 300.00 crores has been sanctioned. The DPR's of refurbishment of water supply which includes intake works, rejuvenation of treatment works, online water quality control system, e-governance, strengthening of billing/collection system and SCADA are to be prepared.

Question: Is the proposed financial structure is sustainable? If so then whether project has been categorized based on financial considerations ?

Yes, the proposed financial structure is sustainable and project has been categorized based on financial considerations.

Question: Have the financial assumptions been listed out ?

Yes, Financial assumptions have been listed out

Question: Does financial plan for the complete life cycle of the prioritized development?

Yes, Financial plan has been done for the complete life cycle of the prioritized development

Question: does financial plan include percentage share of different stakeholders (Centre, State, ULBs)

Yes, Financial plan include percentage share of different stakeholders (Centre, State and ULB)

Question: Does it include financial convergence with various ongoing projects.

Yes, it includes financial convergence with various ongoing projects

Question: Does it provide year-wise milestones and outcomes ?

Yes, Year-wise milestones and outcomes have been provided.

DETAILS IN FINANCIAL PLAN SHALL BE PROVIDED AS PER TABLE 8.1, 8.2, 8.3, 8.4 AND 8.5. THESE TABLES ARE BASED ON AMRUT GUIDELINES TABLES 2.1, 2.2, 2.3.1, 2.3.2, AND 2.5.

Table 8.1 Master Plan of Water Supply Projects for Mission period (As per Table 2.1of AMRUT guidelines)

(Amount in Rs. Cr)

S.No.	Objective	Project Name	Priority number	Year in which to be implemented	Year in which to be completed	Estimated Cost (Cr)
1	Ongoing project under JnNURM	Ongoing project under JnNURM (a) Water supply reorganization priority-1,phase-1 (b) Water supply reorganization priority-1,phase-2 (c) Water supply reorganization priority-2(Trans Varuna)	1	under progress	 2015 2017 2017	 139.79 110.50 268.36 **Total= 518.65**
2	**To achieve universal coverage**	a) To provide house service connection.	2	2015	2016	75 Cr
		b) Bridging the gap in existing network		2016	2019	71.47 Cr
3	**To make system efficient by NRW reduction**	a) Implementation of SCADA with MIS. b) Survey, 100% metering and Leak detection and repair	3	2017	2019	2.20 151.33 **Total = 153.53**
4	**To enhance per capita water supply**	a) Development of new water sources, strengthening of water treatment plant, replacement of rising and distribution main.	4	2018	2019	169 Cr

S.No.	Objective	Project Name	Priority number	Year in which to be implemented	Year in which to be completed	Estimated Cost (Cr)
5	**To improve quality of water**	a) Strengthening of lab and online water quality monitoring system.	5	2016	2019	0.7Cr
					Total	**988.35**

MASTER SERVICE LEVELS IMPROVEMENTS DURING MISSION PERIOD

(As per Table 2.2 of AMRUT guidelines)

(Amount in Rs. Cr)

Sr. No.	Objective	Project Name	Physical Components	Change in Service Levels			Estimated Cost (Cr)
				Indicator	Existing (As-Is)	After (To-be)	
1	**To achieve universal coverage**	a) To provide house service connection.	Water pipe line HH connection	Coverage network,	67%	85%	75 Cr
		b) Bridging the gap in existing network.					71.47 Cr
2	**To make system efficient by NRW reduction**	a) Implementation of SCADA with MIS. b) Survey, 100% metering and Leak detection and repair	Sluice valve/TWetc Meter, pipe line	NRW reduction	58%	30%	2.20 151.33 **Total = 153.53**
3	**To enhance per capita water supply**	b) Development of new water sources, strengthening of water treatment plant, replacement of rising and distribution main.	Water sources and WTP.	NRW Reduction	58%	20%	169.0 Cr
4	**To improve**	Strengthening of lab and online water quality	Lab equipment	Water quality	96%	98%	0.7 Cr

Sr. No.	Objective	Project Name	Physical Components	Change in Service Levels			Estimated Cost (Cr)
				Indicator	Existing (As-Is)	After (To-be)	
	quality of water	monitoring system					
Total							**469.7 Cr**

ANNUAL FUND SHARING PATTERN FOR WATER SUPPLY PROJECTS

(As per Table 2.3.1 of AMRUT guidelines)

(Amount in Rs. Cr)

Sr. No.	Objective	Project Name	Total Project Cost	Share (Cr)			
				GOI	State +ULB	Others	Total
1	**To achieve universal coverage**	a) To provide house service connection.	75 Cr	25	50	0	75 Cr
		b) Bridging the gap in existing network.	71.47 Cr	23.34	48.13		71.47
2	**To make system efficient by NRW reduction**	a) Implementation of SCADA with MIS. b) Survey, 100% metering and Leak detection and repair	2.20 151.33 **Total = 153.53**	50.66	102.87	0	153.53Cr
3	**To enhance per capita water supply**	a) Development of new water sources, strengthening of water treatment plant, replacement of rising and distribution main.	169 Cr	55.77	113.23	0	169.0Cr

Sr. No.	Objective	Project Name	Total Project Cost	Share (Cr)			
				GOI	State +ULB	Others	Total
4	**To improve quality of water**	Strengthening of lab and online water quality monitoring system	0.7 Cr	0.23	0.47	0	0.7Cr
Total			**469.7Cr**	**155.0 Cr**	**314.7 Cr**		**469.7 Cr**

ANNUAL FUND SHARING BREAK-UP FOR WATER SUPPLY PROJECTS

(As per Table 2.3.2 of AMRUT guidelines)

Sr. No.	Project		GOI	State+ULB			Convergence	others	Total
				14th FC	Others	Total			
1	**To achieve universal coverage**	To provide house service connection.	33%	0	67%	0	0		100%
		Bridging the gap in existing network.	33%	0	67%	0	0		100%
2	**To make system efficient by NRW reduction**	c) Implementation of SCADA with MIS. d) Survey, 100% metering and Leak detection and repair	33%	0	67%	0	0		100%
3	**To enhance per capita water supply**	Development of new water sources, strengthening of water treatment plant, replacement of rising and distribution main.	33%	0	67%	0	0		100%
4	**To improve**	Strengthening of lab and	33%	0	67%	0	0		100%

Sr. No.	Project		GOI	State+ULB			Convergence	others	Total
				14th FC	Others	Total			
	quality of water	online water quality monitoring system							

YEAR WISE PLAN FOR SERVICE LEVELS IMPROVEMENTS

(As per Table 2.5of AMRUT guidelines)

Objective		Project Cost	Indicator	Baseline	Annual Targets (Incremet from the Baseline Value)					
					FY 2016		FY 2017	FY 2018	FY 2019	FY 2020
					H1	H2				
To achieve universal coverage	a) To provide house service connection.	75 Cr	Coverage network,	67%	68 %	71 %				
	b) Bridging the gap in existing network.	71.47 Cr				71 %	76%	79%	85%	
To make system efficient by NRW reduction	a) Implementation of SCADA with MIS. b) Survey, 100% metering and Leak detection and repair	153.53 Cr	NRW reduction	58%	--	--	40%	35%	30%	
To enhance per capita water supply	a) Development of new water sources, strengthening of water treatment plant, replacement of rising and distribution main.	169 Cr	LPCD	127 LPCD	--	--	--	132 LPCD	135 LPCD	
To improve quality of water	Strengthening of lab and online water quality monitoring system	0.7 Cr	Water quality	96%	--	96.5%	97%	97.5 %	98%	

STATE ANNUAL ACTION PLAN (SAAP)
UTTAR PRADESH

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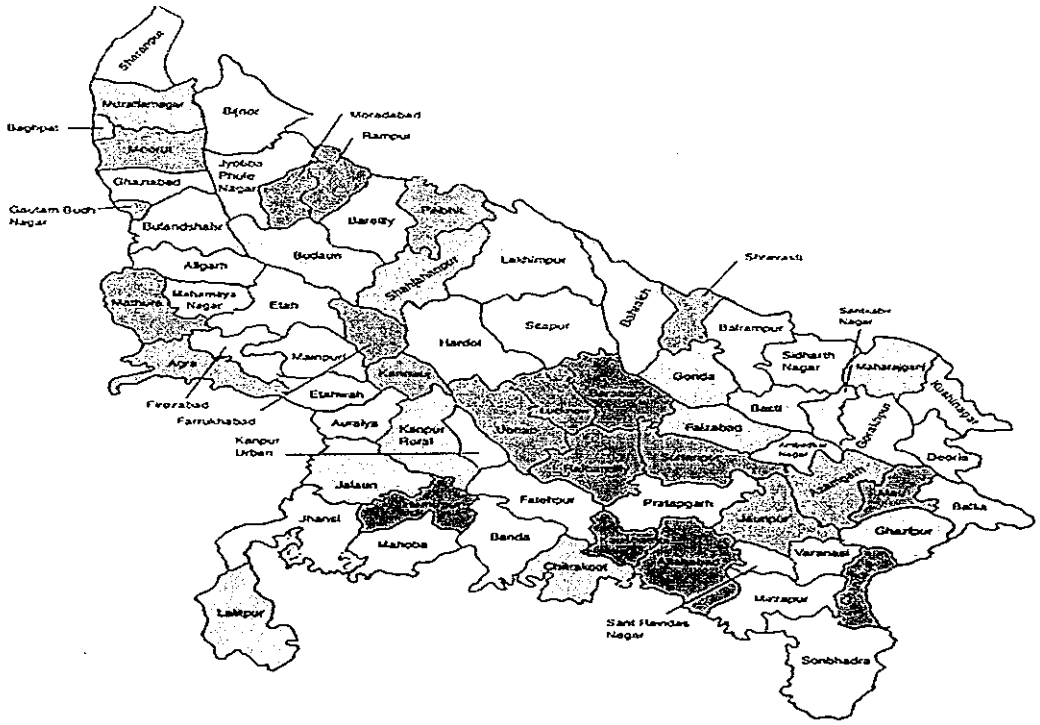
LUCKNOW



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Atal Mission for Rejuvenation and Urban Transformation

Submitted by,

DEPARTMENT OF URBAN DEVELOPMENT, GOVERNMENT OF UTTAR PARESH

DIRECTORATE OF URBAN LOCAL BODIES, GOVERNMENT OF UTTAR PRADESH

REGIONAL CENTRE FOR URBAN & ENVIRONMENTAL STUDIES, LUCKNOW

WATER SUPPLY

NAME OF THE STATE: UTTAR PRADESH

Name of the City	Household level Coverage of Water Supply Connection in %	Per Capita Quantum of Water Supplied in LPCD	Project Cost Demanded by the Cities under AMRUT for Project Period	Project Cost Demanded by the Cities under AMRUT FY 2015-16	Priority No of the Projects
Agra	48	176	743	13.63	WS 1
Aligarh	36	90	656	4.41	WS 1
Allahabad	70	226	684	56.00	WS 1
Bareilly	47	126	41.51	16.88	WS 1
Firozabad	40	214	2.6	0.60	WS 1
Ghaziabad	69	119.5	932.4	45.39	WS 1
Gorakhpur	60	135	296.86	38.00	WS 1
Jhansi	35	126	812.16	224.50	WS 1
Kanpur	68	210	1028.25	135.00	WS 1
Lucknow	63	189	2224	140.00	WS 1
Merrut	51	175	127.75	74.61	WS 1
Moradabad	54	186	48.75	28.75	WS 1
Saharanpur	32	134	74	26.86	WS 1
Varanasi	67	206	469.7	75.00	WS 1
Akbarpur	23	76	23.96	9.63	WS 1
Amroha	32	45	8.81	0.12	WS 1
Azamgarh	50	196	21.52	4.37	WS 1
Budaun	38	216	19.69	3.80	WS 1
Bahraich	51	106	59.17	42.35	WS 1
Ballia	56	138	6.475	4.52	WS 1

Name of the City	Household level Coverage of Water Supply Connection in %	Per Capita Quantum of Water Supplied in LPCD	Project Cost Demanded by the Cities under AMRUT for Project Period	Project Cost Demanded by the Cities under AMRUT FY 2015-16	Priority No of the Projects
Banda	53	199	20.92	16.92	WS 1
Baraut	64	190	16.634	1.52	WS 1
Basti	70	191	16.43	8.43	WS 1
Bulandshahar	33	162	8.4	5.56	WS 1
Chandausi	40	100	14.6	4.50	WS 1
Deoria	33	62	11.875	4.72	WS 1
Etah	34	203	11.855	2.78	WS 1
Etawah	60	140	12.5	0.00	WS 1
faizabad	70	145	26.22	4.68	WS 1
Farrukhabad-cum-Fatehgarh	47	120	14.97	1.80	WS 1
Fatehpur	43	143	5	1.00	WS 1
Ghazipur	55	300	12.85	4.97	WS 1
Gonda	38	281	10.42	3.62	WS 1
Hapur	34	91	33.25	20.50	WS 1
Hardoi	36	90	20.76	7.56	WS 1
Hathras	35	100	42	16.01	WS 1
Jaunpur	60	112	21	12.00	WS 1
Kasganj	45	96	15.24	9.06	WS 1
Khurja	40	158	10.99	4.39	WS 1
Lakhimpur	49	140	51.13	27.60	WS 1
Lalitpur	44	237	26.189	15.99	WS 1
Loni	20	88	26.8	14.20	WS 1

Name of the City	Household level Coverage of Water Supply Connection in %	Per Capita Quantum of Water Supplied in LPCD	Project Cost Demanded by the Cities under AMRUT for Project Period	Project Cost Demanded by the Cities under AMRUT FY 2015-16	Priority No of the Projects
Mainpuri	32	123	32.68	18.98	WS 1
Mathura	60	126	144.29	94.67	WS 1
Maunath	40	96	22.58	6.12	WS 1
Mirzapur-cum-vindhyachal	59	105	139.18	90.89	WS 1
Modinagar	72	184	24.4	0.03	WS 1
Mughalsarai	23	76	17.22	2.56	WS 1
Muzaffarnagar	65	191	24.28	3.05	WS 1
Orai	37	157	7.65	4.43	WS 1
Pilibhit	51	117	26.99	16.40	WS 1
Raibareli	48	66	53.0923	27.00	WS 1
Rampur	17	135	14.5	1.72	WS 1
Shahjahanpur	32	59	34.89	17.89	WS 1
Shambhal	25	105	12.27	0.13	WS 1
Shamli	56	179	17.45	2.55	WS 1
Shikohabad	27	125	4.39	0.04	WS 1
Sitapur	37	89	73.866	25.07	WS 1
Sultanpur	53	141	34.585	27.40	WS 1
Unnao	32	102	193	48.00	WS 1
Total for Mission Period (FY 2015- 19)					
Total for Current Year (FY 2015 - 16)			9587.9513	1519.14	

Table 3.6: SAAP- State Level Plan of Action for Physical and Financial Progress

Name of State – UTTAR PRADESH FY- 2015-16

Name of the City	Performance Indicator	Baseline (%age) (as of date)	Mission target (%age)	For financial Year 2015-16			
				For Half Year 1		For Half Year 2	
				Physical Progress to be achieved	Funds to be Utilized	Physical Progress to be achieved (%age)	Funds to be Utilized (Rs in Crores)
Agra	HH COVERAGE	48	100%			50	5.00
Aligarh	HH COVERAGE	36	100%			40	4.41
Allahabad	HH COVERAGE	70	100%			80	25.00
Bareilly	HH COVERAGE	47	100%			50	10.00
Firozabad	HH COVERAGE	40	100%			45	0.60
Ghaziabad	HH COVERAGE	69	100%			72	25.00
Gorakhpur	HH COVERAGE	60	100%			65	10.00
Jhansi	HH COVERAGE	35	100%			48	50.00
Kanpur	HH COVERAGE	68	100%			70	50.00
Lucknow	HH COVERAGE	63	100%			67	50.00
Merrut	HH COVERAGE	51	100%			55	25.00
Moradabad	HH COVERAGE	54	100%			70	28.75
Saharanpur	HH COVERAGE	32	100%			50	10.00
Varanasi	HH COVERAGE	67	100%			71	30.00
Akbarpur	HH COVERAGE	23	100%			30	5.00
Amroha	HH COVERAGE	32	100%			50	0.12

Name of the City	Performance Indicator	Baseline (%age) (as of date)	Mission target (%age)	For financial Year 2015-16			
				For Half Year 1		For Half Year 2	
				Physical Progress to be achieved	Funds to be Utilized	Physical Progress to be achieved (%age)	Funds to be Utilized (Rs in Crores)
Azamgarh	HH COVERAGE	50	100%			50	4.37
Budaun	HH COVERAGE	38	100%			40	3.80
Bahraich	HH COVERAGE	51	100%			60	20.00
Ballia	HH COVERAGE	25	100%			40	4.52
Banda	HH COVERAGE	53	100%			60	5.00
Baraut	HH COVERAGE	64	100%			64	1.52
Basti	HH COVERAGE	70	100%			75	5.00
Bulandshahar	HH COVERAGE	33	100%			35	5.56
Chandausi	HH COVERAGE	40	100%			45	4.50
Deoria	HH COVERAGE	33	100%			33	0.00
Etah	HH COVERAGE	34	100%			34	0.00
Etawah	HH COVERAGE	60	100%			60	0.00
faizabad	HH COVERAGE	70	100%			80	4.68
Farrukhabad-cum-Fatehgarh	HH COVERAGE	47	100%			50	0.50
Fatehpur	HH COVERAGE	43	100%			43	0.00
Ghazipur	HH COVERAGE	55	100%			43	0.00
Gonda	HH COVERAGE	38	100%			50	3.62
Hapur	HH COVERAGE	34	100%			45	5.00
Hardoi	HH COVERAGE	36	100%			36	0.00
Hathras	HH COVERAGE	35	100%			38	5.00

Name of the City	Performance Indicator	Baseline (%age) (as of date)	Mission target (%age)	For financial Year 2015-16			
				For Half Year 1		For Half Year 2	
				Physical Progress to be achieved	Funds to be Utilized	Physical Progress to be achieved (%age)	Funds to be Utilized (Rs in Crores)
Jaunpur	HH COVERAGE	60	100%			70	5.00
Kasganj	HH COVERAGE	45	100%			45	0.00
Khurja	HH COVERAGE	40	100%			45	2.00
Lakhimpur	HH COVERAGE	49	100%			50	5.00
Lalitpur	HH COVERAGE	44	100%			44	0.00
Loni	HH COVERAGE	20	100%			20	0.00
Mainpuri	HH COVERAGE	32	100%			35	5.00
Mathura	HH COVERAGE	60	100%			60	5.00
Maunath	HH COVERAGE	40	100%			40	0.00
Mirzapur-cum-vindhyachal	HH COVERAGE	59	100%			60	5.00
Modinagar	HH COVERAGE	72	100%			72	0.03
Mughalsarai	HH COVERAGE	23	100%			23	0.00
Muzaffarnagar	HH COVERAGE	65	100%			70	3.05
Orai	HH COVERAGE	37	100%			37	1.00
Pilibhit	HH COVERAGE	51	100%			55	5.00
Raibareli	HH COVERAGE	48	100%			53	10.00
Rampur	HH COVERAGE	17	100%			45	1.72
Shahjahanpur	HH COVERAGE	32	100%			40	5.00
Shambhal	HH COVERAGE	25	100%			50	0.13
Shamli	HH COVERAGE	56	100%			56	0.00

Name of the City	Performance Indicator	Baseline (%age) (as of date)	Mission target (%age)	For financial Year 2015-16			
				For Half Year 1		For Half Year 2	
				Physical Progress to be achieved	Funds to be Utilized	Physical Progress to be achieved (%age)	Funds to be Utilized (Rs in Crores)
Shikohabad	HH COVERAGE	27	100%			35	0.04
Sitapur	HH COVERAGE	37	100%			37	1.00
Sultanpur	HH COVERAGE	53	100%			55	5.00
Unnao	HH COVERAGE	32	100%			35	5.00
							465.93

ANNEX I　Application Form for Japanese Technical Cooperation

APPLICATION FORM FOR JAPAN'S TECHNICAL COOPERATION

1. **Date of Entry:** Day_____ Month _____ Year_____
2. **Applicant:** Varanasi Municipal Corporation, Varanasi, Uttar Pradesh
3. **Project Title:** Project for the Comprehensive Improvement of Environmental Sanitation in Varanasi
4. **Contact Point (Implementing Agency):** Varanasi Municipal Corporation (VMC)

Address: Municipal Corporation Office, Varanasi City, Uttar Pradesh
Contact Person: Mr. Shrihari Pratap Shahi, P.C.S. (Municipal Commissioner)
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5. Background of the Project

Varanasi is considered as one of the most sacred places in the Hindu culture. The rapidly urbanized city along with a large influx of religious tourists has led to the recent degradation in the environmental sanitation of the city and has adversely affected the quality of River Ganges despite the sincere efforts of the relevant authorities and agencies.

One of the most serious environmental issues faced by VMC currently is waste problems. In Varanasi city, 600 tons of waste is generated every day, of which 80% of the waste (480 tons) is estimated to be collected. However, as a matter of fact, waste is scattered around the city and creates an unsanitary environment. This situation significantly deteriorates the landscape of Varanasi. Although currently the VMC directly provides citizens with the waste management service, citizens are not fully satisfied with it. Not only solid waste management but other environmental services such as sewerage management and provision of quality drinking water, though with the lesser degree, have rooms for urgent improvement. Under such circumstances, the project which helps enhance capacities of the relevant officials to tackle all these issues is requested.

6. Outline of the Project

(1) Overall Goal

To improve environmental sanitation in Varanasi and surrounding areas.

(2) Project Purpose

To enhance capacities of VMC to provide citizens with quality water and sanitation services in a sustainable manner.

(3) Outputs

Component A: Solid waste management

OutputA-1: Review of the current solid waste management system in Varanasi

OutputA-2: Capacity enhancement through implementation of the pilot projects

OutputA-3: Sharing the experience of pilot projects with other urban local bodies and providing feedbacks to the existing policies and plans.

Component B: Sewerage and liquid waste management

OutputB-1: Review of the current sewerage and liquid waste management practices in Varanasi

OutputB-2: Enhancement of O&M capacity for sewerage and wastewater infrastructure

OutputB-3: Awareness raising of citizens on public sanitation

Component C: Water supply system

OutputC-1: Reduction of non-revenue water (NRW)

OutputC-2: Awareness raising of citizens on water conservation

(4) Areas to be covered by the Project

Varanasi city and surroundings

(5) Project Activities

<u>Activities for the output A-1:</u>

- To review of the current practices as well as existing plans such as DPR.
- To conduct various surveys, i.e. waste amount and composition survey, time and motion survey, recycling market survey, disposal amount survey and public opinion survey.
- To carry out waste flow analysis.

<u>Activities for the output A-2:</u>

- To conduct actual improvement activities in pilot scale for the following areas;
  - improvement of waste collection and transportation
  - improvement of final disposal site
  - improvement of secondary treatment, i.e. recycling
  - management of waste flow data
  - improvement of waste discharge manner

Activities for the output A-3:

- To organize the seminar on experience sharing
- To present the project experience with the state-level officials as well as the central-level officials in order to mainstream the results of the project

Activities for the output B-1:

- To review of the existing plans of sanitation infrastructure development including STP development and to confirm the current status of ongoing projects financed by other donors and various national schemes.
- To review of ongoing intervention regarding the improvement of sanitation facilities, i.e. Swacch Bharat Mission.

Activities for the output B-2:

- To consider sustainable O&M system for sewer networks and public toilets and to formulate and/or revise O&M manuals of such facilities.
- To consider sustainable O&M system for public sanitation facilities, i.e. on-site treatment system, wastewater treatment facilities and community toilets, and to conduct the necessary pilot project.
- To establish appropriate sludge management system based on the examination of the existing practices as well as the appropriate alternative system including recycling of the sludge.

Activities for the output B-3:

- To expand the public sanitation campaign conducted under ID-P164.
- To conduct awareness raising campaign to eradicate open defecation and to promote use of public toilets.

Activities for the output C-1:

- To review the existing study regarding NRW including the study financed by the World Bank.
- To formulate an action plan for reduction of NRW.
- To implement pilot projects to reduce water leakage and to formulate leakage control manuals
- To estimate the cost for investment necessary for reduction of NRW as well as its benefits.

Activities for the output C-2:

- To conduct awareness raising campaign to promote water conservation.

(6) Input from the Recipient Government

Counterpart personnel, office space and the related machinery and facilities etc., shall be borne mainly by VMC. Currently, the following officials are considered to be major counterparts of the Project.

- Municipal Commissioner, VMC (Project Director)
- Health Officer (Project Manager-1)
- General Manager of Jal Kal (Project Manager-2)

(7) Input from the Japanese Government

In addition to the Japanese experts mentioned below, the cost for pilot activities, the cost for organizing seminars, training in Japan etc., shall be borne by the Project.

- Expert in Sanitation Policy and Sanitation Engineering (Team Leader)
- Experts in solid waste management
- Experts in sewerage and liquid waste management
- Experts in water supply system

7. Implementation Schedule

For approximately three years

8. Description of Implementing Agency

The implementing agency is VMC. Especially the public health department and Jal Kal of VMC will be in charge of project activities.

(i) The organization and financial status of VMC

The organizational setting of VMC is as seen in the chart below. The officials and workers engaged in solid waste management are as follows.

- Chief health officer (1)
- Zonal sanitary officers (4)
- Sanitary inspectors (12)
- Sanitary supervisor s (34)
- Sanitary workers (2,600)

The financial status is also shown in the tables in the next page.

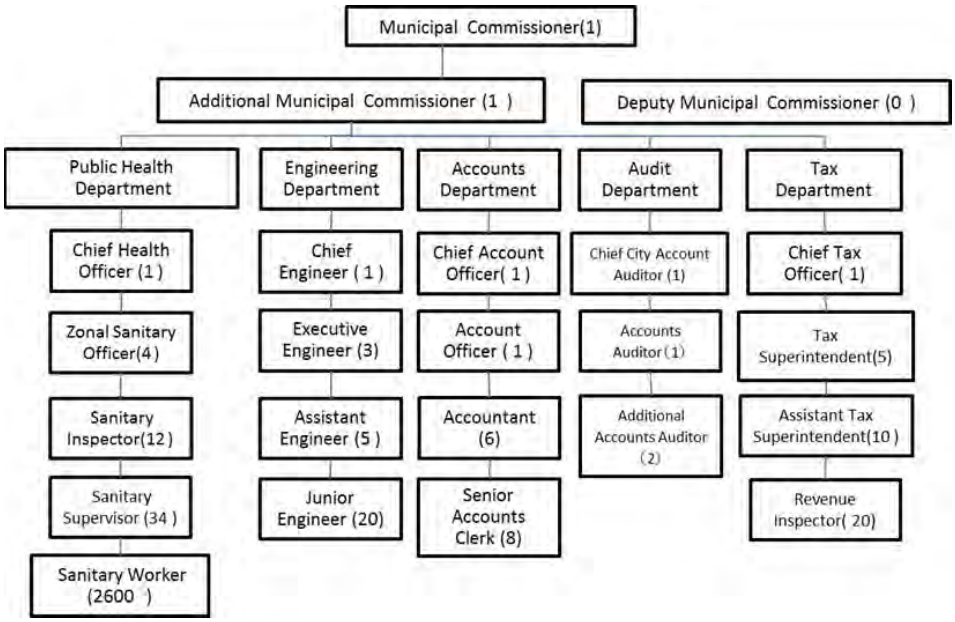

Figure 1: Organizational chart of VMC (except Jal Kal)

Table 1: Revenue of VMC

Item of Revenue	Fiscal Year					
	2008	2009	2010	2011	2012	%
Tax Revenue						
Property Tax	1,186	1,358	1,384	2,500	2,600	
Consolidated Tax	133	138	234	408	408	
Sub Total	1,319	1,496	1,618	2,908	3,008	14%
Non Tax Revenue						
Rent from Municipal Properties	170	196	147	695	905	
Building Permit fees	347	576	917	1,100	2,200	
Fees from licenses	13	13	15	22	22	
Road cutting fees	96	450	849	1,000	1,200	
Water Taxes and charges	1,616	1,582	1,692	3,515	3,865	
Sewage Taxes and charges	142	251	331	328	340	
Others	76	111	153	558	577	
Sub Total	2,460	3,179	4,104	7,218	9,109	44%
Assigned Revenue and Grants						
Genral Programs	28	4	2,282	750	750	
Life Insurance for State Gov. Employee	19	18	4	30	30	
Education Grant	6	24	10	38	40	
Other State Gov. Grant	154	-710	206	300	300	
Family Planning	70	50	90	80	100	
State Finance Commission	3,738	4,196	5,317	6,300	7,500	
Sub Total	4,015	3,582	7,909	7,498	8,720	42%
Total	7,794	8,257	13,631	17,624	20,837	100%

Table 2: Expenditure of VMC

Item	Fiscal Year					
	2008	2009	2010	2011	2012	%
Salaries						
Finance and Revenue Department	432	464	561	725	635	
General Administration	243	285	323	443	396	
Public Works	363	393	471	642	605	
Public Health Department	2,990	3,014	3,254	4,740	4,505	
Other Department	428	222	140	160	150	
Pension, PF and others	659	826	859	1,600	2,000	
Water Works （Jalkal）	1,242	0	2,073	853	2,155	
Sub Total	6,357	5,204	7,681	9,163	10,446	54%
Operation and Maintenance						
General Administration	373	320	1,044	3,538	5,470	
Public Works	117	120	148	225	210	
Education, Sports and youth welfare	1	1	1	6	6	
Public Health Department	47	25	12	446	426	
Solid Waste Management	210	197	215	212	212	
Zonal & Other Department	74	69	49	128	121	
Water Works（Jal Kal）	920	0	2,714	74	2,458	
Sub Total	1,742	732	4,183	4,629	8,903	46%
Total	8,099	5,936	11,864	13,792	19,349	100%

(ii) The organization and financial status of Jal Kal

Although Jal Kal has been amalgamated into VMC since 2010, Jal Kal still maintains its operational independence to a certain degree. The organizational setting is as follows.

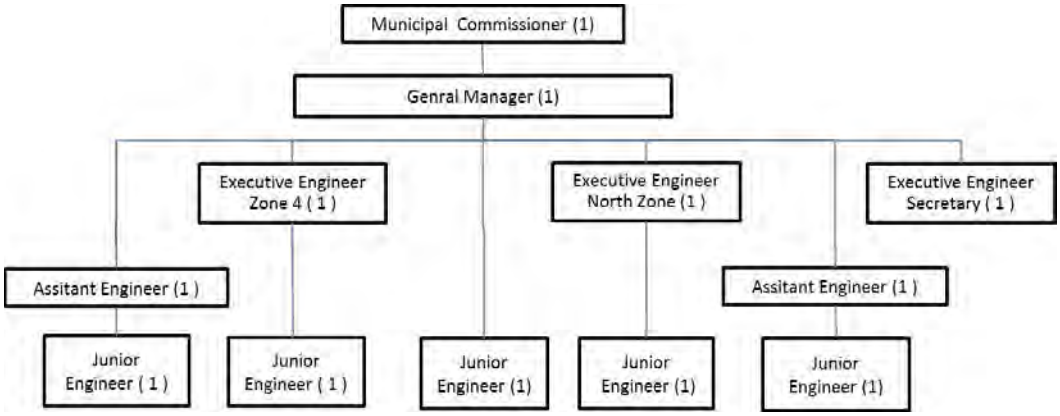

Figure 2: Organizational chart of Jal Kal

The financial status is shown in the table 1 and 2. Three items, (i) road cutting fees, (ii) water taxes and charges and (iii) sewage taxes and charges in table 1 are revenue of Jal Kal, while the expenditure of Jal Kal is indicated as figures under Water Works (Jal Kal) in table 2.

9. Related Information

(1) Prospects of further plans and actions/ Expected funding resources for the Project:

The project will be carried out in close collaboration with the related state departments as well as the relevant central ministries by aiming the good practices of the project will be replicated beyond the project site.

(2) Projects by other donor agencies, if any:

- A part of Capacity Building for Urban Development Project financed by the World Bank, the study "Developing Strategy for Reduction of Non-Revenue Water in Varanasi Nagar Nigam (DPR)" was conducted.
- As of August 2015, the World Bank has just started to formulate a project to finance solid waste management projects in Uttar Pradesh through Construction and Design Service Unit of UP Jal Nigam.

(3) Other relevant Projects

In Varanasi, several private companies are active in the area of solid waste management, as follows.

- Indian Oil Company plans to construct five decentralized methanization plants which utilize biodegradable wastes in the city to produce methane gas, as a part of their CSR activities. The size of each plant is rather small and expected to consume 5 to 10 tons per plant of biodegradable wastes.
- Airport Authority of India plans to organize cleaning campaign along the Ghats of River Ganges, as a part of their CSR activities.
- VMC plans to cooperate with a NGO to conduct pilot activities in a small scale, i.e. composting and community-based recycling.

(4) Other relevant information

No particular information.

10. Global Issues (Gender, Poverty, Climate change, etc.)

The improvement of environmental sanitation benefits all the citizens and especially female citizens who take care of household environment and family health.

11. Environmental and Social Consideration

(Please fill in the attached screening format.)

12. Beneficiaries

    Primary beneficiaries are to be people living within the boundary of VMC. According to the Census 2011, the population of VMC is 1,198,491.

13. Security Conditions

    Special attention in terms of security is needed only during the local elections. Otherwise, no special consideration is required in this regard.

14. Others

    Nothing particular.

Signed:_____

Position/Organization:_____

On behalf of the Government of India

Date:_____

ANNEX 4

Screening Format (Environmental and Social Considerations)

Question 1 Address of a project site
Varanasi Municipal Corporation and surrounding, Varanasi District, Uttar Pradesh State, India

Question 2 Outline of the project
2-1 Does the project come under following sectors?
■Yes ☐No

If yes, p1ease mark corresponding items
☐ : Mining development
☐ : Industrial development
☐ : Thermal power (including geothermal power)
☐ : Hydropower, dams and reservoir
☐ : River/erosion control
☐ : Power transmission and distribution lines
☐ : Roads, railways and bridges
☐ : Airports
☐ : Ports and harbors
■ : Water supply, sewage and waste treatment
■ : Waste management and disposal
☐ : Agriculture involving large-scale land-clearing or irrigation
☐ : Forestry
☐ : Fishery
☐ : Tourism

2-2 Does the project include the following items?
☐ : Yes ■ : No

If yes, please mark following items.
☐ : Involuntary resettlement (scale: households , persons)
☐ : Groundwater pumping (scale: m3/year)
☐ : Land reclamation, land development and land-clearing (scale hectors)
☐ : Logging (scale: hectors)

2-3 Did the proponent consider alternatives before request?

☐ : Yes: Please describe outline of the alternatives
( )
■ : No

2-4 Did the proponent have meetings with related stakeholders before request?

☐ : Yes ■ : No

If yes, please mark the corresponding stakeholders.

☐ : Administrative body

☐ : Local residents

☐ : NGO

☐ : Others (

Question 3

Is the project a new one or an on-going one? In case of an on-going one, have you received strong complaints etc. from local residents?

■ :New ☐ : On-going(there are complaints) ☐ : On-going (there are no complaints) ☐ : Others ( )

Question 4 Name of laws or guidelines:

Is Environmental Impact Assessment (EIA) including Initial Environmental Examination (IEE) required for the project according to laws or guidelines in the host country?

☐ : Yes ■ : No

If yes, please mark corresponding items.

☐ : Required only IEE (☐ : Implemented , ☐ : on going, ☐ : planning)

☐ : Required both IEE and EIA (☐ : Implemented , ☐ : on going, ☐ : planning)

☐ : Required only EIA (☐ : Implemented , ☐ : on going, ☐ : planning)

☐ : Others

Basically IEE and EIA are not required for implementation of technical cooperation project whose main components are capacity development of the relevant officials through planning and training activities. Moreover, although the project includes infrastructure improvement as a part of pilot projects, such sanitation infrastructure is not newly constructed but only improved.

Question 5

In case of that EIA was taken steps, was EIA approved by relevant laws in the host country? If yes, please mark date of approval and the competent authority.

☐ : Approved without a supplementary conditions

☐ : Approved with a supplementary conditions

☐ : under appraisal

(Date of approval: Competent authority:)

☐ : Not yet started an appraisal process
☐ : Others:( )

Question 6

If a certificate regarding the environment and society other than EIA, is required, please indicate the title of certificate.

☐ : Already Certified ☐ : Required a certificate but not yet done.
Title of the certificate.:( )
■ : Not required
☐ : Others（ ）

Question 7

Are following areas located inside or around the project site?

☐ : Yes ■ : No ☐ : Not Identified

If yes, please mark the corresponding items.

☐ : National parks, protected areas designated by the government (coast line, wetlands, reserved area for ethnic or indigenous people, cultural heritage) and areas being considered for national parks or protected areas
☐ : Virgin forests, tropical forest
☐ : Ecological important habitat areas (coral reef, mangrove wetland, tidal flats)
☐ : Habitat of valuable species protected by domestic laws or international treaties
☐ : Likely salts cumulus or soil erosion areas' on a massive scale
☐ : Remarkable desertification trend areas
☐ : Archaeological, historical or cultural valuable areas
☐ : Living areas of ethnic, indigenous people or nomads who have a traditional lifestyle, or special socially valuable area

Question 8

Does the project have adverse impacts on the environment and local communities?

☐ : Yes ☐ : No ☐ : Not identified
Reason：（ ）

Question 9

Please mark related environmental and social impacts, and describe their' outlines.

☐ : Air pollution
☐ : Water pollution
☐ : Soil pollution
■ : Waste
☐ : Noise and vibration
☐ : Ground subsidence

■ : Offensive odors
□ : Geographical features
□ : Bottom sediment
□ : Biota and ecosystem
■ : Water usage
□ : Accidents
□ : Global warming
□ : Involuntary resettlement
□ : Local economy such as employment and livelihood etc.
□ : Land use and utilization of local resources
□ : Social institutions such as social infrastructure and local decision-making institutions
□ : Existing social infrastructures and services
□ : The poor, indigenous of ethnic people
□ : Maldistribution of benefit and damage
□ : Local conflict of interests
□ : Gender
□ : Children's rights
□ : Cultural heritage
□ : Infectious diseases such as HIV/AIDS etc.
□ : Others ( )

Outline of related impacts:
(Currently waste is scattered and odor near waste heap annoys citizens. The project aims to reduce such negative impacts. Also, the project includes an activity to promote water conservation, and such component may have impact on water usage.)

Question 10
Information disclosure and meetings with stakeholders

10-1 If the environmental and social considerations are required, does the proponent agree on information disclosure and meetings with stakeholders in accordance with JICA Guidelines for Environmental and Social Considerations?
■ : Yes □ : No

10-2 If no, please describe reasons below.
( )