



NEW TOWN KOLKATA DEVELOPMENT AUTHORITY

(A Statutory Authority Under Government of West Bengal)
3, Major Arterial Road, New Town, Kolkata - 700 156

Memo. No. 9207 /NKDA/EE – IV/58/2019

Date: 26/12/2019

NOTICE INVITING e-TENDER

Notice Inviting e-Tender No: WBNKDA/02/EE–IV/NKDA/2019-20

Executive Engineer IV, New Town Kolkata Development Authority invites percentage rate tender from resourceful, reliable, bona-fide and experienced working contractors of KMDA, WBHIDCO, PWD, PHED, Railways and other Govt. and semi Govt. organizations having experience in similar nature of work, and are requested to submit their offer for the work detailed below.

(Submission of Bid through **online**)

List of Schemes :-

Name of work	Estimated Amount (Rs.)	Earnest Money (Rs.)	Price of Tender documents (Rs.)	Period of completion
Roof-top solar, vertical green wall and rainwater recharge proposal at nkgsccl building	1,09,27,568/- (Rupees one crore nine lakh twenty seven thousand five hundred seventy eight only)	2,19,000/- (Rupees two lakh nineteen thousand only)	Rs. 2,505.00 Each set to be paid only by the successful bidder during the time of agreement	12 months

1. In the event of e-filling, intending bidder should download the tender documents from the website <http://wbtenders.gov.in> indirectly with the help of Digital Signature Certificate. All the bidder shall have to submit earnest money & necessary earnest money will be deposited by the bidder through the following payment mode as finance dept. order no-3975-F (Y) dated 28th July 2016 (Annexure–A)
 - i) Net banking (any of the banks listed in the ICICI Bank payment gateway in case of payment through ICICI payment gateway).
 - ii) RTGS/NEFT through bank account in any bank. The EMD shall be deposited in favour of “New Town Kolkata Development Authority” payable at Kolkata.
2. Both Technical bid and Financial bid are to be submitted concurrently duly digitally signed in the website <https://wbtenders.gov.in>. The acceptance of lowest bid is not obligatory.

3. Tender documents may be downloaded from website and submission of Technical Bid and Financial Bid will be done as per Time Schedule stated in Sl. No. 14 of this NIT.
4. The **FINANCIAL OFFER** of the prospective qualified tenderer(s) will be considered only if the **TECHNICAL BID** of the tenderer(s) is found qualified by competent authority of New Town Kolkata Development Authority. The decision of the competent authority of New Town Kolkata Development Authority will be final and absolute in this respect. The list of Qualified Bidders will be displayed in the website.
5. In term of Finance Department, Audit Branch, Govt. of West Bengal's Notification no.4374-F(Y) dated 13th July, 2017, the bidder has to upload valid 15-digit Goods and service Taxpayer Identification Number (GSTN) under GST Act, 2017, along with his bid. The bidder should note that bid submitted without GSTIN will be summarily rejected
6. In term of finance dept. Govt. of West Bengal **G.O. no-4608-F (Y)** dated 18th July 2018 when bid rate is 80% or less of Estimated Amount put to tender, the Bidder shall submit Additional Performance Security @ 10 % of the Tendered Amount from any Schedule Bank, before issuance of work order.

The Additional performance security shall be submitted in the form of Bank Guarantee from any scheduled Bank before issuance of the work order. If the bidder fails to submit the additional performance security within seven working days from the date of issuance of Letter Acceptance, his earnest money will be forfeited and other necessary action as per NIT like blacklisting of the contractor, etc. may be taken. The bank Guarantee shall have to be valid up to end of the contract period and shall be renewed accordingly, if required.

7. Eligibility criteria for participation in the tender.

- I. Working Contractors of NKDA, KMDA, WBHIDCO, PWD, PHED, Railways and other Govt. & semi Govt. organization having satisfactorily completed (as prime contractor) similar nature of single work of value not less than Rs.44,00,000/- (Rupees forty four lakh only) during last 5(five) years prior to the date of issue of the tender notice.

OR

- II. Intending tenderer may also produce credential of 02 (two) similar nature of completed work, each of value not less than Rs.33,00,000/- (Rupees thirty three lakh only) during last 5(five) years prior to the date of issue of the tender notice.

OR

- III. Intending tenderer may also produce credential of one single running work of similar nature which has been completed to the extent of 80% or more and value of which is not less than the estimated value. In case of running works, only those tenderers who will submit the certificate of satisfactory running work from the concerned Executive Engineer, or equivalent competent authority will be eligible for the tender. In the required certificate it should be clearly stated that the work is in progress satisfactorily and also that no penal action has been initiated against the executing agency, i.e, the bidder.

- IV. . Bonafied resourceful contractor having Nursery in his possession with valid documents and having a trade license on Nursery work and equivalent Profession Tax Certificate on nursery work.

- V. Preferably have office & field service setup to provide good after installation services including necessary repair and maintenance in the state of West Bengal.
- VI. Bidder should have completed/ongoing at least single contract of vertical gardening with Procurement and installation of LoRaWAN based soil humidity sensors with long battery life (~5 years) with successful maintenance of the same in West Bengal.
- VII. Payment certificate will not be treated as credential.
- VIII. Credential certificate issued by the Executive Engineer or equivalent or competent authority of a state/central Government, state/ central Government undertaking statutory/ Autonomous bodies constituted under the central/ state statute, on the executed value of completed/ running work will be taken as credential.
- IX. Intending Tenderer must be financially sound with a minimum average turnover of Rs.1 Crore, (Rupees One Crore only) during the last three financial years and having a trade license, G.S.T Registration certificate and Profession Tax certificate.
- X. PAN Card, Income Tax Return Acknowledgement Receipt for the last 03 (Three) Assessment years, G.S.T, P.T. Deposit Challan for the year 2018-2019.
- XI. Registered Partnership Deed for Partnership Firms only along with Power of Attorney since executed under any Judicial Magistrate/First Class Magistrate is to be submitted. The company shall furnish the Article of Association and Memorandum as on-statutory documents.
- XII. Joint Ventures/MOU will not be allowed.
- XIII. Three consecutive years' Audit report to be submitted along with Tender documents.
- XIV. The Bidder should be capable to engage a reputed MNRE approved manufacturer of Solar PV Modules (using mono/poly silicon crystalline Cells) or a Solar PV System Integrator and should have experience of having executed contracts of Supply, Installation and Commissioning of Roof Top Solar PV power plant (s) with at least one such project having an installed capacity of minimum 50 kWp in one location and operating successfully for at least 1 year after commissioning.

8. Similar work means:-

- i) Work involving vertical gardening with Procurement and installation of LoRaWAN based soil humidity sensors with long battery life maintenance of the same.

OR

- ii) Work involving installation of solar photo voltaic panels with associated maintenance of the same.

OR

iii.) Arboriculture work with ornamental plants including special species of plants as described in the tender document.

9. Fund for this project has been made available from the Smart City Mission by the New Town Kolkata Green Smart City Corporation Limited.
10. On-going payments or part payment for work may be allowed to the executing agency as per existing rules. Subject to deduction of security deposit, progressive payment may be made against the completed or partly completed item of works. Such interim payments, shall be made as running account bill (s), however, shall not constructed to mean that the respective items / components have finally been approved and accepted by NKDA and the contractor shall not be absolved of his responsibility to set right any deficiency of such paid items / components at his/ their own cost, for rectifying all defects which are subsequently being noted or found.
11. No claim for interest or compensation will be entertained in respect to any money or balance of payment which may be due or alleged to be due to the contractor owing to any dispute between the contractor and NKDA or in respect to any delay in making payment of progressive or final bill of the work, to the contractor.
Payment for the works done by the contractor will be based on recorded and accepted measurement at various stages of work. Acceptance of measurements put for payment to be invariably made by putting signature (with seal) of the contractor (or his/ their authorized representative). The contractor or his / their authorized representatives are advised to take measurements jointly with the officials of NKDA. In case of failure on his/their part either to take measurement jointly and /or acceptance of the recorded measurement, within a reasonable time, measurement taken by the department shall be considered as final for making payment. Similar acceptance is also essential for level records and survey data, field books etc.
12. **No advance and secured advance will be allowed.**
13. **Idle labour, idle rent and hire charges etc.:**
No claim of any category and type, on this ground shall be entertained. The contractor and NKDA shall make every effort that such situation does not arise.
14. **Testing and Testing Equipment:** Testing of materials, to be used in work and the quality of finished work on quality control aspect, is to be undertaken by the contractor at their own cost, with facilities provided at site and / or through approved (by NKDA) Test Houses / Laboratories. All materials and workmanship shall be in accordance with the specifications laid down in the contract and also as per P.W.D.(Buildings& Road Scheduled) and IS Codes . The Engineer-in-Charge reserves the right to test, examine and measure the material / workmanship direct at the place of manufacture, fabrication or at the site of works or any suitable place. The contractor shall provide such assistance, instrument machine, labour and materials as the Engineer-in-Charge may require for examining, measuring and testing the works and quality, weight or quantity of materials used and shall supply samples for testing as may be selected and required by the Engineer-in-Charge without any extra cost. Beside this, he/they will carry out tests from outside Laboratory as per instruction of Engineer-in-Charge. The cost of all such tests would be borne by the agency.

Should the Chief Engineer or his representative consider it necessary to

satisfy himself/themselves as to quality of work, the contractor shall offer sample of work done as necessary, pull down reasonable part of the work required for inspection and testing. The contractor shall bear the cost of pulling down and shall make good the same at their own cost and to the full satisfaction of E-I-C without any claim for payment.

15. Security Deposit:

Retention money towards performance Security amounting to 8% (eight percent) of the value of the work shall be deducted from the running account bill of the tenderer as per prevailing order. No interest will be paid on the money retained for Security Deposit.

16. Date and Time Schedule:

Sl. No.	Particulars	Date & Time
1	Date of uploading of N.I.e.T. & other Documents (online) (Publishing Date)	26/12/2019
2	Date , venue and time of pre bid meeting	03/01/2020 at 2.00 P.M. At Conference Room of NKDA, 01, MAR, New Town, Kolkata -700156
3	Documents download start date (Online)	26/12/2019 from 4.00 P.M.
4	Documents download end date (Online)	20/01/2020 upto 10.00 A.M.
5	Bid submission start date (On line)	26/12/2019 from 4.00 P.M.
6	Bid Submission closing (On line)	20/01/2020 upto 10.00 A.M.
7	Bid opening date for Technical Proposals (Online)	22/01/2020 upto 10.00 A.M.
8	Last date of uploading list for Technically qualified Bidder(online)	Will be intimated in due course
9	Date of opening of Financial Proposal(online)	Will be intimated in due course
10	Last date of intimation to the successful bidder	Will be intimated in due course

17. Earnest Money for the successful tenderer will be retained and converted as Initial Security deposit. The Balance security deposit @ 8% will be deducted from on-going bills to cover the total value of work done.

a) The security deposit of the successful tenderer will be refunded after defect liability period as stipulated in relevant clause of the agreement to be made in WBF2911(ii).

18. The tenderers are bound by the terms & conditions of WBF 2911(ii) along with specification, notice for calling Tenders, Special terms & condition, Information to Bidders, Schedule of works etc, which forms a part and parcel of this contract.

19. Income Tax & G.S.T will be deducted as per Govt. orders issued from time to time and would be applicable on the date of making payment of the bills. Building & other construction workers cess @ 1.0% will be deducted from progressive bills in pursuance with G.O. no. 599A/ 4M – 28 / 06 dated 27/09/2006.

20. The Bidder, at his own responsibility and risk is encouraged to visit and

- examine the site of works and its surroundings and obtain all information that may be necessary for preparing the Bid and entering into a contract for the work as mentioned in the Notice Inviting e-Tender, before submitting offer with full satisfaction. The cost of visiting the site, shall be at his own expenses.
21. The intending Bidders shall clearly understand that whatever may be the outcome of the present invitation of Bids, no cost of Bidding shall be reimbursable by the Department. New Town Kolkata Development Authority reserves the right to accept or reject any offer without assigning any reason whatsoever and is not liable for any reimbursement of any cost that might have been incurred by any Tenderer at any stage of Bidding.
 22. Prospective applicants are advised to note carefully the minimum qualification criteria before tendering the bids.
 - 23. Conditional / Incomplete tender will not be accepted under any circumstances.**
 - 24. The intending tenderers are required to quote the rate online. The rate should be inclusive of all components and taxes.**
 25. Contractor shall have to comply with the provisions of (a) the contract labour (Regulation Abolition) Act. 1970 (b) Apprentice Act. 1961 and (c) minimum wages Act. 1948 and the notification (s) thereof or any other laws relating thereto and the rules made and order issued there under from time to time.
 26. During scrutiny, if it comes to the notice of the tender inviting authority that the credential or any other paper found incorrect / manufactured / fabricated, that bidder would not be allowed to participate in the tender and that application will be rejected without any prejudice.
 27. If there be any objection regarding prequalification of any Agency the same should be lodged on line to Executive Engineer IV, New Town Kolkata Development Authority within 2 (two) days from the date of publication of list of qualified agencies and beyond the said time schedule no objection will be entertained
 28. Before issuance of WORK ORDER, the Tender Inviting Authority may verify the credential and other documents of the lowest tenderer if found necessary. After verification if it is found that the documents submitted by the lowest tenderer is either manufactured or false in that case work order will not be issued in favour of the said Tenderer under any circumstances and his/their offer will be treated as cancelled.
 29. If any discrepancy arises between two similar clauses on different notification, the clause superseding others will be solely as per the discretion of the Tender inviting authority.
 30. The successful Tendered whose tender is accepted shall make formal agreement in WBF 2911 (ii) along with bid documents in triplicate, within 7 (seven) days from the date of issue of work order by Executive Engineer IV, New Town Kolkata Development Authority on payment of usual charges which is non-refundable under any circumstances and submit the same duly signed by him/them to this office. If the contractor fails to perform the formalities within the specified period the Tender is liable to be cancelled and the Earnest Money will be forfeited as per relevant clauses under memorandum of WBF 2911(ii).
 - 31. Qualification criteria:**
The tender inviting and Accepting Authority will determine the eligibility of

- each bidder. The bidders shall have to meet all the minimum criteria as stipulated in relevant clauses of this NIeT.
32. The eligibility of a bidder will be ascertained on the basis of the document(s) submitted in support of the minimum criteria. If any document submitted by a bidder is either manufactured or false, in such **cases the eligibility of the bidder / tenderer will be rejected at any stage** without any prejudice to take any penal action against him/them as may be deemed fit by the Tender Accepting Authority.

AND

- The agency must have the capacity to engage laborers as directed by EIC.
33. The agency should supply the materials as per confirming to IS mark and specification laid down in schedule and also to be taken approval from EIC / his representatives before utilize in work.
- 34.No. price preference and other concession as per order no. 1110F dated: 10/02/2006 will be allowed.**
35. Agencies are required to give a work programme preferably in the form of a bar- chart and to get it approved by the EIC (Engineer-in-Charge) before commencement of work and if progress of work abruptly differs from such work programme, the undersigned may terminate the work order at any point of time and penal action as per Tender Terms and conditions will be imposed.
36. Unless otherwise stipulated, all the works are to be done as per general conditions and general specifications of the latest edition of 'PWD (W.B) schedule of Rates for Building, Roads, and Sanitary Plumbing' works for the working area.
37. In case of any inadvertent typographical mistake in the specific price schedule of rates, the same will be treated to be so corrected as to confirm with the prevailing relevant schedule of rates and/or technically sanctioned estimate.
38. Intending tenderer should note that he may have to work simultaneously with other contractors already entrusted with other work or with contractors to be entrusted with other work in future in the same site. The contractor will have to work in close co-operation and harmony with all the contractors engaged in the project. Any claim for idle labour, for any reason whatsoever, will not be entertained under any circumstances.
39. NKDA will not be held responsible for making payment against any anticipated profit and/or compensation for any losses or price escalation whatsoever for the works as stated in the annexure of this NIeT. Rates should be quoted accordingly.
40. The address as furnished by the contractor shall be deemed as the postal address of this office. Any notice or instruction to be given to the contractor under the terms of contract shall be deemed to have been served if it has been delivered to his authorized agent (on the strength of authorization) or representative or sent by registered letter to his official address as furnished.
41. Arbitration clause of WBF 2911(ii) stands deleted.
42. New Town Kolkata Development Authority reserves the right to increase or decrease the quantum of work as stipulated in the schedule of work for which no change of rate will be allowed.
43. Participation in this tender deems that the applicant is fully agreeable to abide all terms and conditions as stated in this Notice Inviting e tender as well as WBF 2911(ii).

44. Mobilization advance, time / cost overrun and consequent cost escalation for any material, labour, etc. will not be allowed.
45. All materials are to be procured and supplied at site of work by the tendered /firm at his / their own cost from approved reputed dealer / manufacturer. Departmental materials will not be issued under any circumstances unless any such provision is made and accepted latter by both the parties. Department unless otherwise stated means New Town Kolkata Development Authority.
46. The offer shall remain valid for 180 days from the date of opening of the tender.

47. Special condition:

- i) Credentials of Sub vendors engaged for one and/or more parts of the work has to be approved by the Engineer In Charge (EIC).
- ii) The selected bidder shall during the time of the work remain responsible wholly for all the actions and/or inaction of the sub vendors engaged.
- iii) Action may be taken against the selected bidder for non-performance and /or substandard performance of the sub vendors.
- iv) Action may be taken against the selected bidder if payment made against ongoing work is not transmitted to the concerned vendor in due time.
- v) The decision of the EIC shall be final in this respect.

48. Brief Scope of work:

Execution of the following work as instructed by the EIC at the indicated location on the roof top and adjacent vacant space of utility building beside tank no. 3 at AI/154/1, Premises No : 09/1-0024 Action, West Bengal 700156action area IA

- i) Survey of the site and preparation of working engineering drawing for the work.
 - ii) Getting the working drawing vetted by the EIC
 - iii) Dismantling of all type of masonry work to make the roof team available for the project work
 - iv) MS structural work with hollow section for mounting of solar power modules and vertical green walls.
 - v) Design, Supplying, Installation, commissioning with five years comprehensive maintenance of solar panels systems of 63.36kW capacity(min) inclusive of Poly-Crystalline solar panels, grid tied inverters, balance of electrical system with all Accessories on the roof top and inclusive of all labour machinery, etc complete.
 - vi) Supply fitting and fixing and three years maintenance of vertical garden on the periphery of the roof top of the site as per design and to the satisfaction of the EIC
 - vii) Supply fitting and fixing of pipe structure with appropriate special parts for capturing and harvesting rainwater.
 - viii) Construction of inspection pit, pipe line and UGR for storage of harvested rainwater.
 - ix) Laying of garden on the top of UGR
 - x) Finishing and painting of all the components as per design and as directed by the EIC.
- (For more details refer to the BOQ file at the appropriate link which is an integral part of this tender document)

49. Evaluation Method:

Evaluation of the bids will be made on the basis of submitted credentials

the opinion of the tender inviting authority will be final on this matter.

50. Enclosure:

- i) Location plan
- ii) Proposed Design
- iii) Approved make list.

**Executive Engineer IV
New Town Kolkata Development Authority**

Memo. No. 9207/1(12) /NKDA/EE – IV/58/2019

Date: 26/12/2019

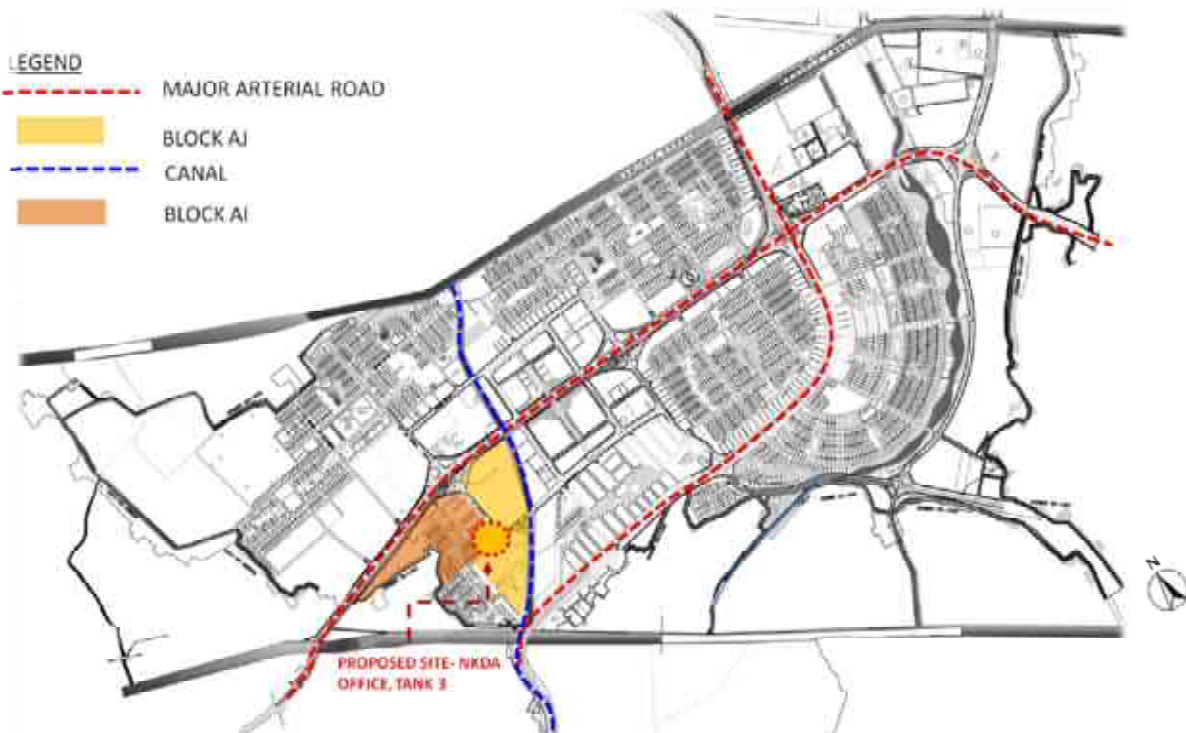
Copy forwarded for information to:-

- 1. The Chief Executive Officer, New Town Kolkata Development Authority.
- 2. The Chief Engineer, New Town Kolkata Development Authority
- 3. The Chief Executive Officer, New Town Kolkata Green Smart City Corporation Limited
- 4. Administrative Officer I & II New Town Kolkata Development Authority
- 5. Chief Finance officer, NKGSCCL
- 6. Chief Technical Officer, NKGSCCL
- 7. Technical Officer, NKGSCCL
- 8. The Finance Officer, New Town Kolkata Development Authority
- 9. Executive Engineer-II, Executive Engineer IVI, Executive Engineer I & ME
New Town Kolkata Development Authority
- 10. The Estimator/ Sr. Accountant / Cashier, New Town Kolkata Development Authority.
- 11. Office Notice Board.
- 12. Official Website of New Town Kolkata Development Authority
(www.nkdamar.org)

**Executive Engineer IV
New Town Kolkata Development Authority**

Location plan

The new town area majorly consists of mixed-use development with residential being predominant and several major commercial centers. With the increasing demands of electric supply, PV systems provides the solution of allowing residential and commercial buildings to generate their own electricity from solar power. Solar energy being one of the clean, pollution free and renewable sources of energy generation is initiated by the New town Kolkata Development Authority for their pilot intervention which is a roof top photo voltaic system proposed on the roof of Utility building near tank 3 at AI block.

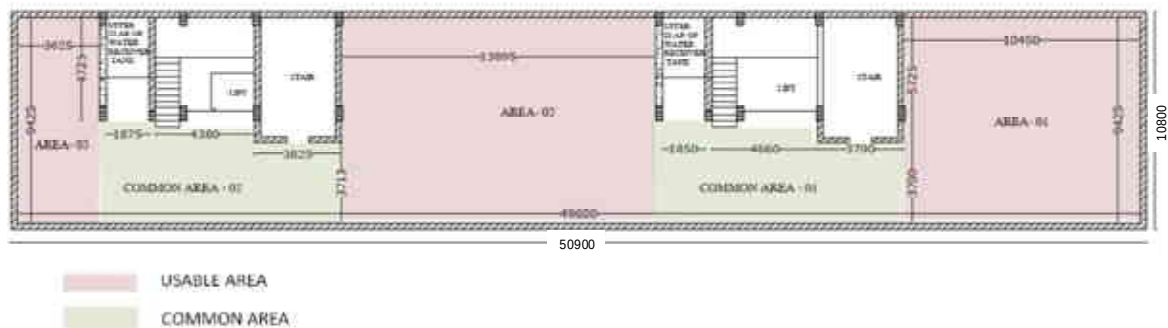


Proposed project site area
Source: NKDA



Proposed project site near tank 3, Newtown Kolkata
Source: Google Earth

The proposed site is a roof top of a linearly planned NKDA building on the 5th floor with the total area being 467.48 sqm. The proposed area is divided into three usable spaces and two common areas to access the core of the building.



Roof plan for proposed roof top PV system at Utility building
Source: NKDA



Site Photographs



Existing available roof area at Utility Bilding for Rooftop solar installation- view 1
Source: Photo captured on 17.10.2019



Existing available roof area at Utility Building for Rooftop solar installation- view 2
Source: Photo captured on 17.10.2019



Existing available roof area at Utility building for Rooftop solar installation- view 3
 Source: Photo captured on 17.10.2019



Existing available roof area at utility building for Rooftop solar installation- view 3
 Source: Photo captured on 17.10.2019

Proposed Design

The project is proposed to be installed on the rooftop of the Utility Building located in New Town Kolkata. Brief details of the proposed site are given below for general reference:

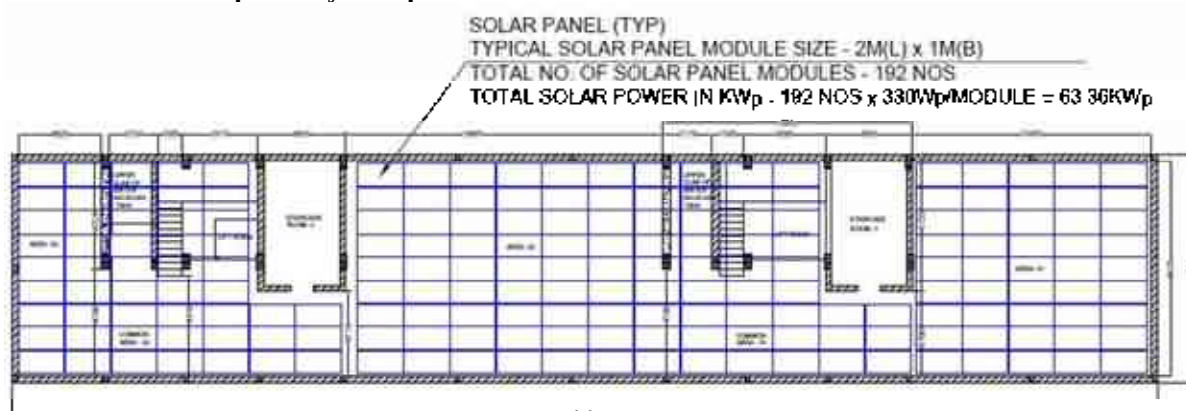
Location : Utility Building, 6th Floor, Plot No : AI/154/1, Premises No 09/1-0024 Action Area - IA, (Near Tank no 3), New Town Kolkata - 700156

Latitude & Longitude : 22.5785° N, 88.4527° E

Site Altitude : 6 M from main sea level

Proposed Capacity : As per below drawing. Bidders can propose alternative capacities and module ratings to be accommodated within the given area. Adequate care shall be given to ascertain any impact of adjacent tall structures (mobile tower, water tank etc.) in terms of shading losses. Any area that is likely to be affected on account of shading losses, shall be clearly indicated in the proposal and any impact on the capacity of the system shall be clearly specified.

Elevated roof solar panel layout – plan



Proposed plan for Elevated roof solar panel layout at Utility building

Source: NKDA

Proposed Energy generation

AREA DESCRIPTION	AREA DIMENSIONS IN METRE (L X B)	NO. OF SOLAR PANEL MODULE IN NOS (A)	Wp PER MODULE (B)	TOTAL KWp (A x B) / 1000
AREA 01	10150 x 9425	40	330	14.86
AREA 02	13300 x 9425	60	330	20.79
AREA 03	3525 x 9425	27	330	8.91
COMMON AREA 01	10580 x (4700+3700)	33	330	10.89
COMMON AREA 02	10950 x (4700+4410+3710)	21	330	7.02
TOTAL		152	-	63.36

Figure 0-1: Proposed Energy generation through rooftop solar at Utility building

Source: NKDA

Considering the tropical location of the site, it is recommended to go for poly crystalline PV modules which are well suited for this ambient condition.

As the solar PV is a fast-emerging industry in terms of technological evolution, bidders can propose alternative materials or modules or products that are fully compliant with the relevant IS and IEC technical requirements and their products shall be certified by BIS or any other equivalent reputed certification authorities.

PV Module

Proposed Solar PV modules are of reputed make having comparable or better ratings than the minimum ratings indicated below as per their type tested design solutions. The offered modules shall be compliant to relevant IEC and IS requirement.

Note: Bidder to specify the following ratings as per their proposed design. Current ratings considered are as follows:

ULE TECHNICAL SPECIFICATION – 50Wp

- Per Module rating : Min.320Wp (Higher rating are acceptable)
- Solar cell type : Poly crystalline (recommended)
- Peak power voltage (Vmp) at 25°C : 37 V
- Peak Power current (Imp) at 25°C : 8.9 A
- Open circuit voltage (Voc) at 25°C : 46.4 V
- Short circuit current (Isc) at 25°C : 9.4 A
- Solar module frame material : Aluminium Alloy (Frameless modules acceptable)
- Superstrate : High transmission glass

Inverter

String Inverters (modular) are proposed for evacuating the generated power to feed the existing Lighting and HVAC loads on the fifth floor of the NKDA building. The minimum technical requirements that are required to be complied are listed below. Better options with more features are acceptable and will be considered.

- Type of Inverter : String Inverter, Grid Tied
- Nominal Rating for each Inverter : 30kVA
- No. of Inverters : 2 Nos
- Max. DC Input Voltage : 1000V DC
- AC Output Voltage : 400V +/- 10%
- AC Output Frequency : 50Hz +/- 5%
- Mounting Arrangement : Wall or Structure Mounted
- Degree of Protection : IP65
- Form Factor : Compact type, Small Size
- Total Harmonic Distortion (THD) : <3% at rated power
- Parallel Operation with DG Supply : Desirable
- Inverter Efficiency : 98% or better

Mandatory Protections:

- DC Disconnection Switch : Yes
- DC Reverse Polarity Protection : Yes
- DC Short Circuit Protection : Yes
- DC String Fuse : Yes
- AC Short Circuit Protection : Yes
- Over Voltage Protection : Yes

Mounting System for Modules

The area available on the roof shall be utilised to the maximum extent while taking into consideration shading losses and other access requirement for existing roof components.

A clear headroom clearance of 2.5m shall be provided between the roof of the building and the bottom of the PV modules. The support structures shall be suitable for withstanding the wind loads as per is for the Kolkata location. The column footing and cross-sectional details shall be determined by the installation contractor and the PV supporting roof beam and column structures shall be designed to transfer the additional dead load to the existing building columns.

The module mounting structure shall be designed for holding suitable number of modules in series. The frames and leg assemblies of the module mounting structure shall be manufactured using standard materials. The module mounting structure shall be designed in such a way that it will occupy minimum space without sacrificing the output from solar modules and at the same time it will withstand severe wind speed up to 150 kmph (horizontal wind speed).

The roofing system shall be either conventional sheet steel roofing or if there are alternative solar PV roofing systems can also be provided as alternative option.

For conventional sheet steel roofing system following minimum requirements shall be complied:

- Sheet Roof array structure made of aluminium alloy
- Modules mounted using aluminium clamps
- Enough gap between Roof and Modules to be maintained for air circulation
- SPV panel mounted parallel to roof tilt
- Structure designed for simple mechanical and electrical installation
- There shall be minimum or no requirement of welding or complex machinery at site

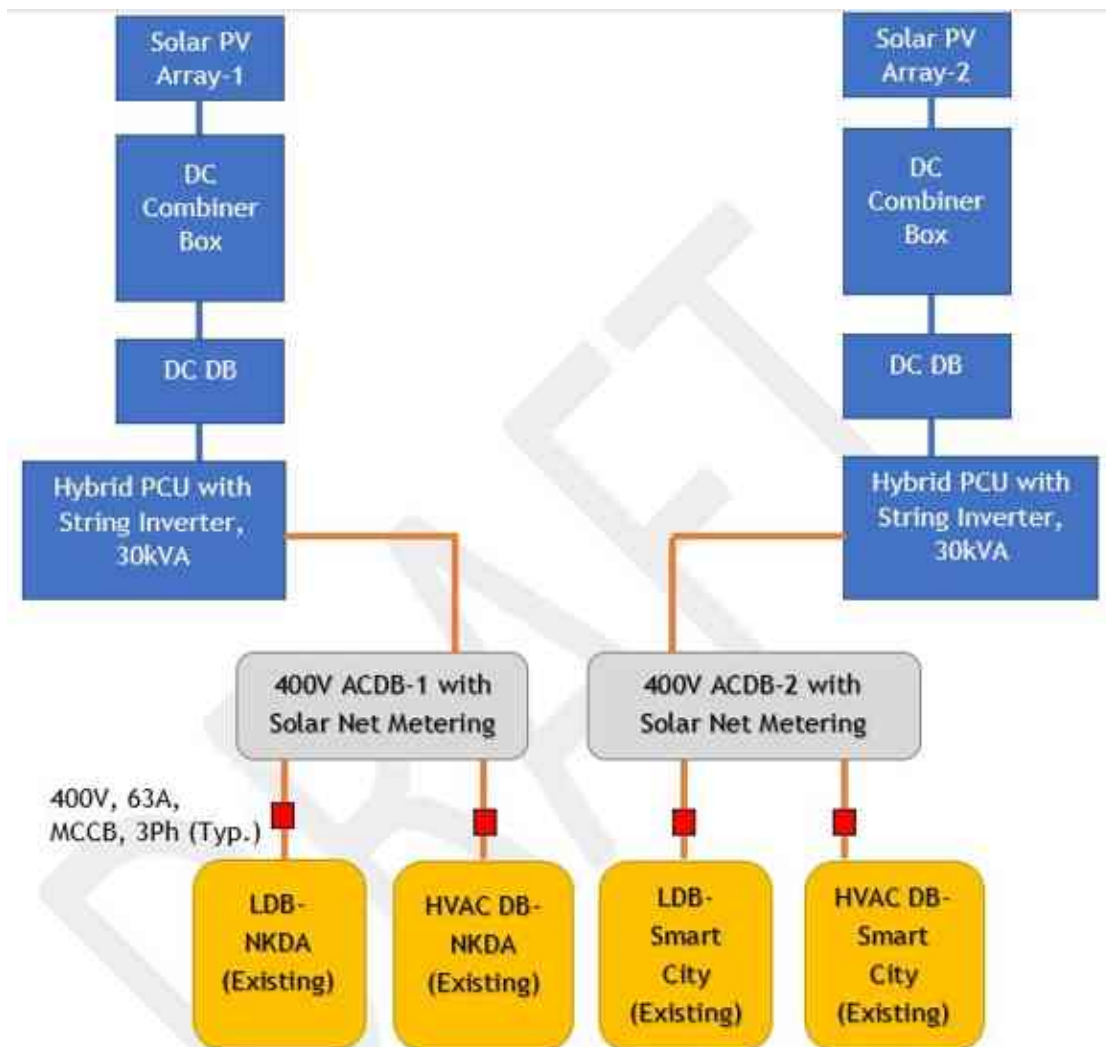
Innovative rooftop solar PV systems having integrated PV modules along with the roof systems can be proposed as an alternative option.

Balance of Electrical Systems

- Yellow/Green Copper earthing cables of adequate cross sections shall be used for grounding of all metallic structures and electrical systems that are included in the offered system.
- Early Streamer type of Lightning protection system shall be included
- Integration of the Inverter AC output with the existing building Lighting and HVAC Distribution Boards, including the necessary modifications to existing DBs as needed to complete the grid integration, shall be included as part of the scope of this system.
- Maintenance lighting systems (for building roof access during night time) shall be included as part of the scope of this system installation works
- Safe access to the solar PV roof, maintenance personnel safety gear during cleaning of solar PV modules shall be detailed out by the vendor considering the working at height conditions involved in regular cleaning and maintenance of the modules.

Electrical System Conceptual Block Diagram:

The below electrical system is shown indicatively for purpose of understanding the potential arrangement for integration of the roof top solar PV system with the existing building AC DB at 5th floor level. The arrangement is subject to change based on the actual load and switchgear ratings vis-à-vis the bid proposal ratings.

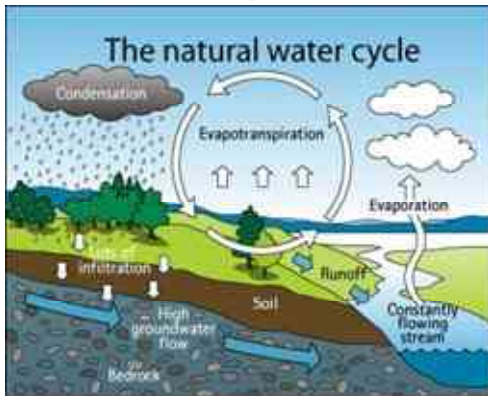


Concept block diagram of electrical layout for proposed PV solar project at utility building
 Source: NKDA

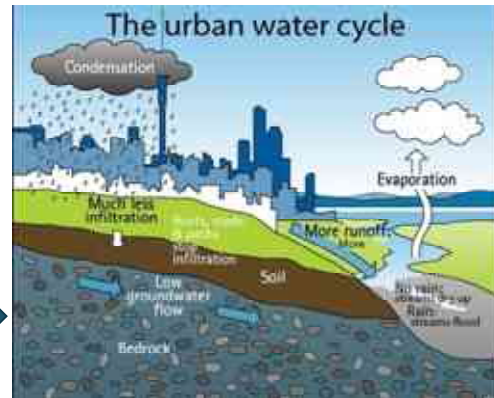
Rainwater Harvesting

The process of natural replenishment of underground water storage/reservoir is slow and therefore it is difficult to keep pace with high abstraction rate and excessive groundwater exploitation. With the increase in urbanization, the land area for natural rainwater recharge is also shrinking as most of the open area is getting converted into paved surfaces.

Artificial recharge to groundwater aims at augmentation of the groundwater storage by modifying the natural movement of surface water through suitable civil construction techniques to enhance percolation rate under natural conditions of replenishment.



In natural hydrological cycle the water follows through the stages of **precipitation**, which turns into surface runoff, **infiltration**, and **percolation**, and lastly reaches the river bodies before finally taking the form of clouds by **evaporation**, **transpiration** and **evapotranspiration**. This keeps the water cycle balanced



Due to urbanization, this water cycle is influenced by the pervasive existence of impervious surfaces that limits the amount of infiltration, resulting in high levels of storm water runoff, limited groundwater replenishment, this ultimately generates huge quantity of rain water which is wasted.



This wasted water can be harvested or can be used for recharging the groundwater and make hydrological cycle more sustainable.

Rainwater Harvesting in Urban Condition

Source: NKDA

Design Standards

All designs proposed for RWH structure including construction material like PVC pipes and civil works shall confirm to the various standards & codes as explained below

- Space Standard for Roads in Urban Areas (IRC:69-1977)
- Guidelines on Road Drainage (IRC SP 42:2014)
- Guidelines on Urban Drainage System (IRC SP 50:2013)
- Bureau of Indian Standards
- PCMC DC Rules: Rainwater Harvesting
- Plain and Reinforce Concrete: Code of Practice IS: 456-2008
- Design Aids for Reinforced Concrete SP-16.6. Handbook on Concrete Reinforcement and Detailing SP-34

Design Parameter

It is essential to derive an efficient and appropriate design to ensure the efficient performance of the rooftop rainwater harvesting system which depends upon the detailed analysis of design parameters like

- Pattern of rainfall,
- Character of catchment zone,
- Size of filtration pit,
- Filtration material

Rainfall pattern in the project area is one of the most important design which governs the different components of RWH system like size of filtration pit, storage tank and dimensions of water collection network etc.

Size and dimensions of the rainwater down take pipe and water collection network is regulated by the intensity of rainfall and Runoff co-efficient of the catchment area.

The rainfall intensity considered for the design is 40 mm/hour based on the details received from the client.

Rainfall runoff Calculation

a) Rainfall Runoff Calculations:

As mentioned in IRC-SP-50 code for Urban Drainage System, for small watershed areas the Rational Method is widely used for calculating the runoff discharge.

$$Q = (C \times i \times A)/1000$$

where,

Q = Runoff Discharge in m³/hr

C = Co-efficient of runoff

i = Rainfall intensity in mm/hr

A = Catchment area in m²

Catchment Area of Roof is = 513.1 m²

Co-efficient of Runoff (C) :0.9 (as per IRC-SP-50, Table 6.1)

Rainfall intensity :40 mm/hr

$$Q = (0.9 \times 40 \times 513.072) / 1000$$

$$= 18.47 \text{ m}^3/\text{hr}$$

Assuming 4 hrs of retention time, the Rainwater storage volume is calculated.

$$Q = (18.470592) \times 4$$

$$\mathbf{Q = 73.88 \text{ m}^3}$$

b) Rainwater Storage tank calculation:

Adopted storage for Rainwater storage tank is : 79 m³

Length (L): **6.0 m**

Width (W): **6.0 m**

Depth of water storage (D) :**2.2 m**

Assuming the free board to be 0.3m, the internal dimension of Storage tank will be = 6.0 x 6.0 x 2.5 m

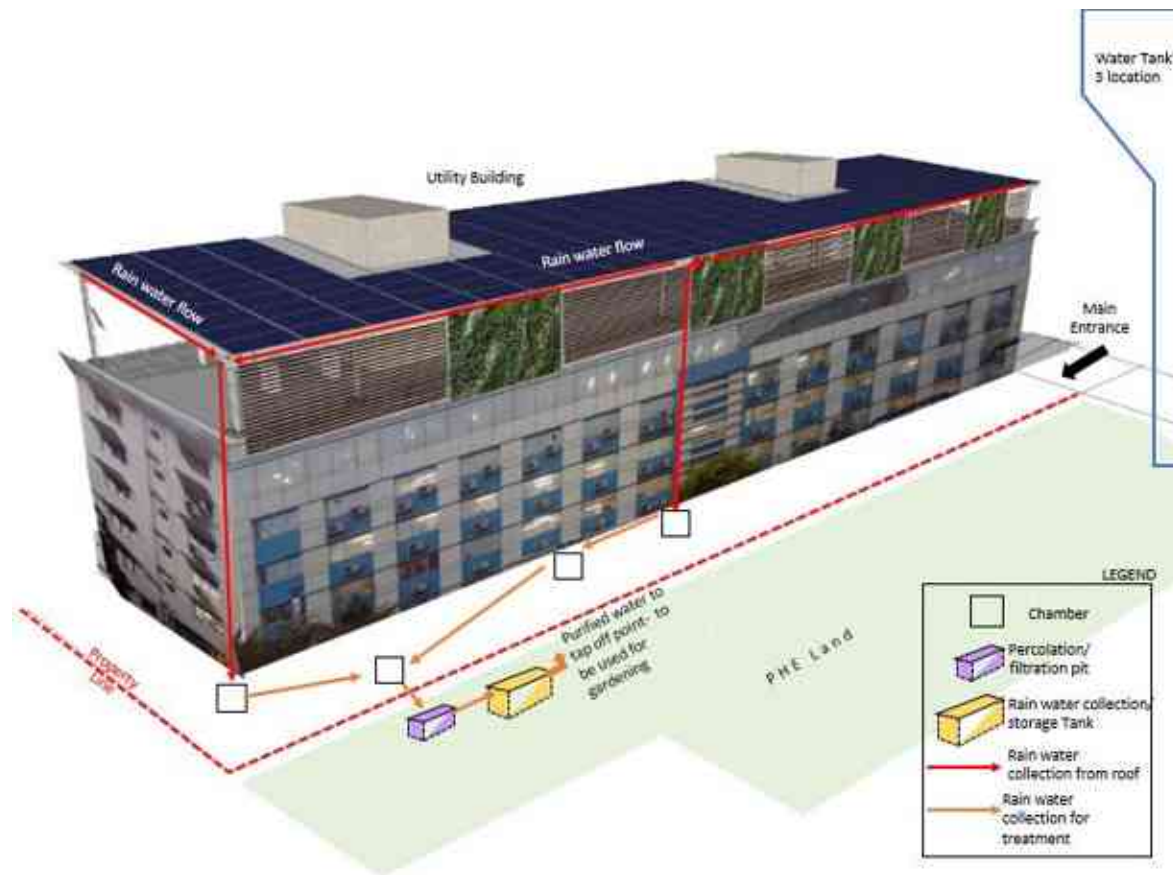
Proposed Design

There are numerous techniques available for rooftop rainwater harvesting for urban development. The adopted technique for the NKDA building is a **Storage Tank with a filtration pit.**

The final design of RWH is derived based upon the prevailed environment and geological conditions of the NKDA area. Some of the major components in Rooftop Rainwater Harvesting (RRWH) system right is the collection of rainwater, its conveyance to the filtration pit and subsequently facilitation into the Storage tank. The Final design of roof top rainwater harvesting system adopted is shown below Figure.

This method is adopted for the following reasons

- It preferred in the areas where there is distributed rainfall for whole year
- Water should not be stored for longer period and it is better to maintain continuous flow
- It is preferred to allow water into recharge tank after filtration



Proposed view of Rainwater Harvesting

Source :NKDA

A rainwater harvesting system comprises of following components

a) **Rainwater Catchment Area**

In RRWH System, terrace area is termed catchment area. The location of recharge pit is also decided depending upon the slope of the catchment zone. Runoff coefficient is an important parameter for the designing of the RWH system which has been as 0.90 for rooftop.

b) **Rainwater Conveyance Pipes (Conduits)**

These pipes carry rainwater from the rooftop area to the RWH system. Commonly used pipes material is polyvinyl chloride (PVC) or galvanized iron (GI). There are mainly of two types to convey the rainwater to recharge pit while passing through the chambers, leaf collector and grit collector

1. Down take pipes

2. Rainwater collection pipes.

Beyond the bottom of the down take pipe all piping work shall be done under ground. *Size of the down take pipe and trunk pipeline is anticipated 150 mm respectively.* PVC pipes of 200mm dia is proposed all around.

c) **First Flush**

Generally, first spell rain is dumped out to prevent entry of pollutant in the RWH system with the help of a flushing device which is a sluice valve. This is also shown in the typical drawing of RWH system. Before the entry of water pit, a tee along with scour valves on both ends has to be provided, so that water from the first rain is washed away through scour valve.

d) **Filtration Pit**

This includes Filtration pit and storage tank facility. This is the main structure, which facilitates the process of filtration in the recharge pit to remove suspended pollutants from rainwater and ensuring better water quality before rainwater is sent to the storage tank.

The aggregate filter, which is proposed at the base of pit, have three layers of which two layers of sand is on top and one layers of gravels at lowest level.

Periodic maintenance measures like disinfection and cleaning are required to ensure/check the quality of rainwater before percolating to ground water.

Benefits of Rainwater Harvesting

Rainwater Harvesting System provides following benefits:

- **Create Communal Spaces and Areas:**
RWH sites bring the community closer to water and creates new recreational spaces for all to enjoy.
- **Enhance Aesthetics and Biodiversity of the Landscape:**
RWH design enhances the aesthetics and biodiversity of the landscape while slowing down the flow of runoff. This creates local green in plots and communal spaces by integrating nature into urban life
- **Detain and Treat Rainwater:**
RWH design features are natural treatment elements to detain and treat runoff before it is discharged into ground water from there to water bodies. With seamless integration with the landscape and drainage system, both hydrological benefits and water quality improvement can be realised, in addition to other environmental benefits.
- **Educating the Public:**
At the core of this project is the social aspect of getting the public involved in ensuring sustainability of scarce water resources by inculcating a sense of stewardship towards water. RWH sites can also provide experiential learning for the younger generation to learn about water management.



RWH spaces for Community activities

Vertical Green Walls

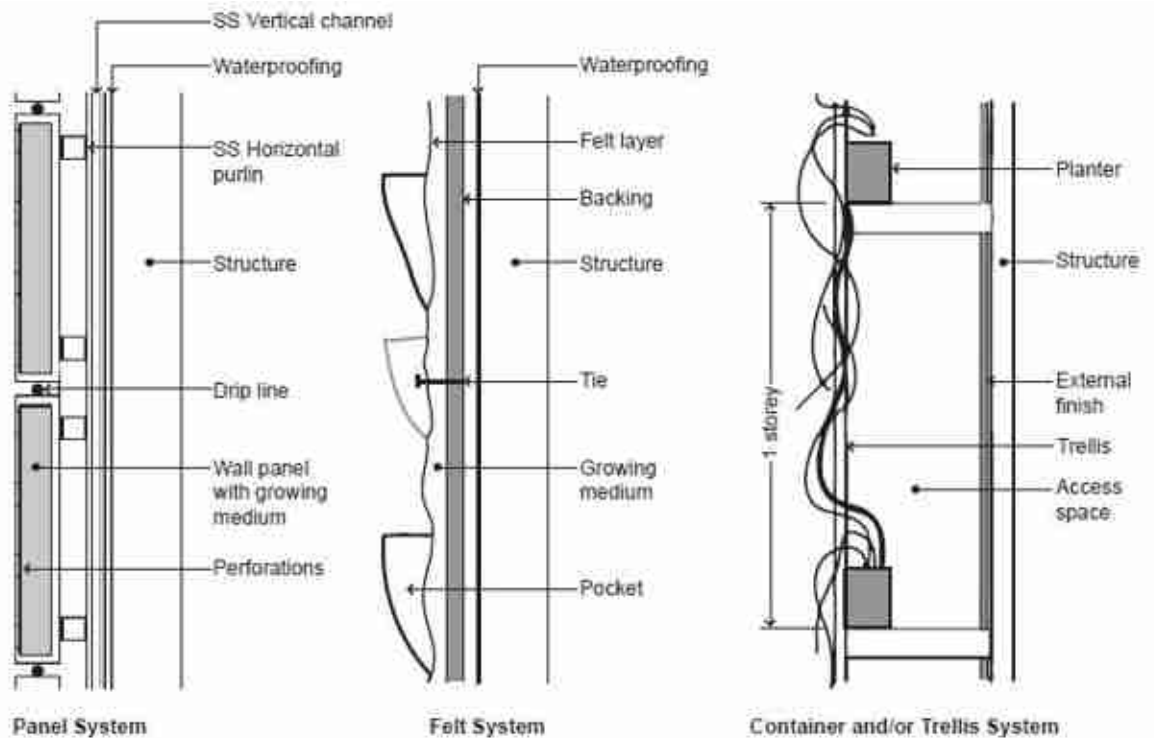
Green walls or vertical gardens are vertical surfaces with vegetation. Not only are they aesthetically pleasing, they also improve air quality and check indoor and outdoor air temperature amongst other things.

They are developed as part of modular green roof systems. They comprise modular panels holding plant and soil media, and have integrated irrigation systems, vegetation and geo-textile. The modular panels can either be anchored to a metal framework or directly to a wall surface. The framework holds the panels in place as per design.



Modular Living wall-examples from Canada and Atlanta Botanical Garden
Source: Vertical Gardens, By Özgür Burhan Timur and Elif Karaca

Types of Vertical Green wall:



Types of green wall

Source: Vertical Gardens, By Özgür Burhan Timur and Elif Karaca

Proposed Design

Geo Mesh Felt system:

This system comprises of a PP mesh with 36 pockets for plant placement. Ideally suited for indoor and outdoor application. Plants are pre-grown and acclimatized before installation. It incorporates an automated drip-based irrigation system which has a battery or electrical timer option for automation.

Installation: Each panel is pre-fitted with 4 aluminium hooks. These hooks are then mounted on 35mm GI channels installed on the wall or a prefabricated MS frame using 3inch anchor screws.

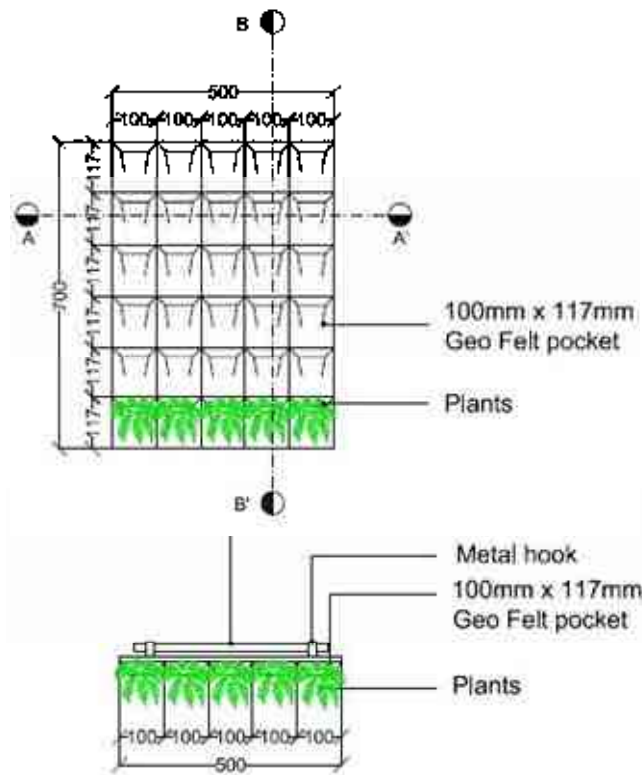
Irrigation: 16mm irrigation pipes with drippers fitted into the module.

Drainage: Civil Drain out point is the ideal option while in the absence of that, FRP/Metal drain of width 150/200mm x height 150/200mm container can be fitted by the length of the green wall.

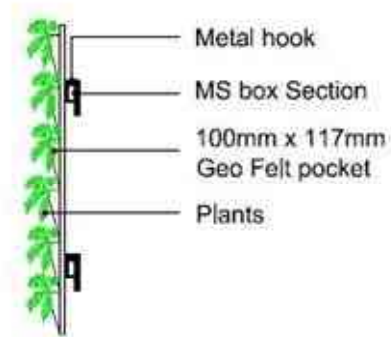
- **Panel Size:** 700 x 500mm

- **No of Plants per SFT:** 16(approximately)
- **Weight per Panel:** 15 Kgs including irrigation system (approximately)

Front Elevation



Section BB



Section AA

Typical plan & section details of geo mesh felt module

Source: Natura Greentech Pvt Ltd

Benefits of Vertical Gardens

Vertical Green walls provide the following benefits:

- **Aesthetically pleasing**

Green walls or living walls bring instant visual appeal to a barren wall or a large urban space. The pre-grown plant material provides a finished look from day one. They provide much wanted relief from large urban eye sores, service structures, transport elements.

- **Conserves water**

Green walls use an integrated drip irrigation or a hydroponic system for watering the plants. Waste water is collected at the bottom in a tray after which it is either drained or recycled. Thus, there's very little wastage of water. (On an average, as little as 1.2L/sq. m. /day)

- **Improves air quality**

Green walls improve air quality through bio-filtration. VOC's and other contaminants like airborne pollutants are expelled from the interiors, thus providing clean air for breathing.

- **Checks noise pollution**

Living walls reduce noise pollution. The level of noise reduction depends on the depth of the growing media and the materials used as structural system.

- **Live plants decrease stress levels, create peaceful ambience**

Presence of plants in an office not only reduces stress but also helps increase worker's productivity. It's also true that presence of interior plants creates a peaceful and fresh ambience and inspires creativity amongst employees. In Canada, green walls are placed inside buildings to help offset SAD (Seasonal Affective

Disorder).

- **Increases value of neighbourhood**

According to a study, green plants can increase the value of property by 6-15%. Plants can dramatically increase visual perception of a place. They project a positive perception of a place as they're part of amenity and recreational spaces in a neighbourhood.

- **Restores places for wildlife**

Living walls 'mimic' biodiversity and provide food, shelter for wildlife like birds, butterflies, thus restoring wildlife habitats. It is important to choose the correct plant species.

- **Mitigates the urban heat island effect**

Increase in urban development has resulted in high urban heat island effect. Vegetation cools buildings and the surrounding area through shading, reducing reflected heat, and evapotranspiration. Green walls promote natural cooling processes. It mitigates the urban heat island effect.

Recommended Species of plants

Considering New town Kolkata climate, the PMU recommends the following plant species for vertical green wall proposal.



Representative image of Rhoeo spathacea compacta variegata



image of Ophiopogon japonicus (mondo grass)



Representative image of Polystichum munitum (sword ferns)



Representative image of Pink nephthytis syngonium



Representative image of Philodendron cordatum



Representative image of Epipremnum aureum (money plant)



Representative image of Chlorophytum comosum



Representative image of Tradescantia pallida

Proposed Views



Figure 0-2: Proposed View 1
Source: NKDA



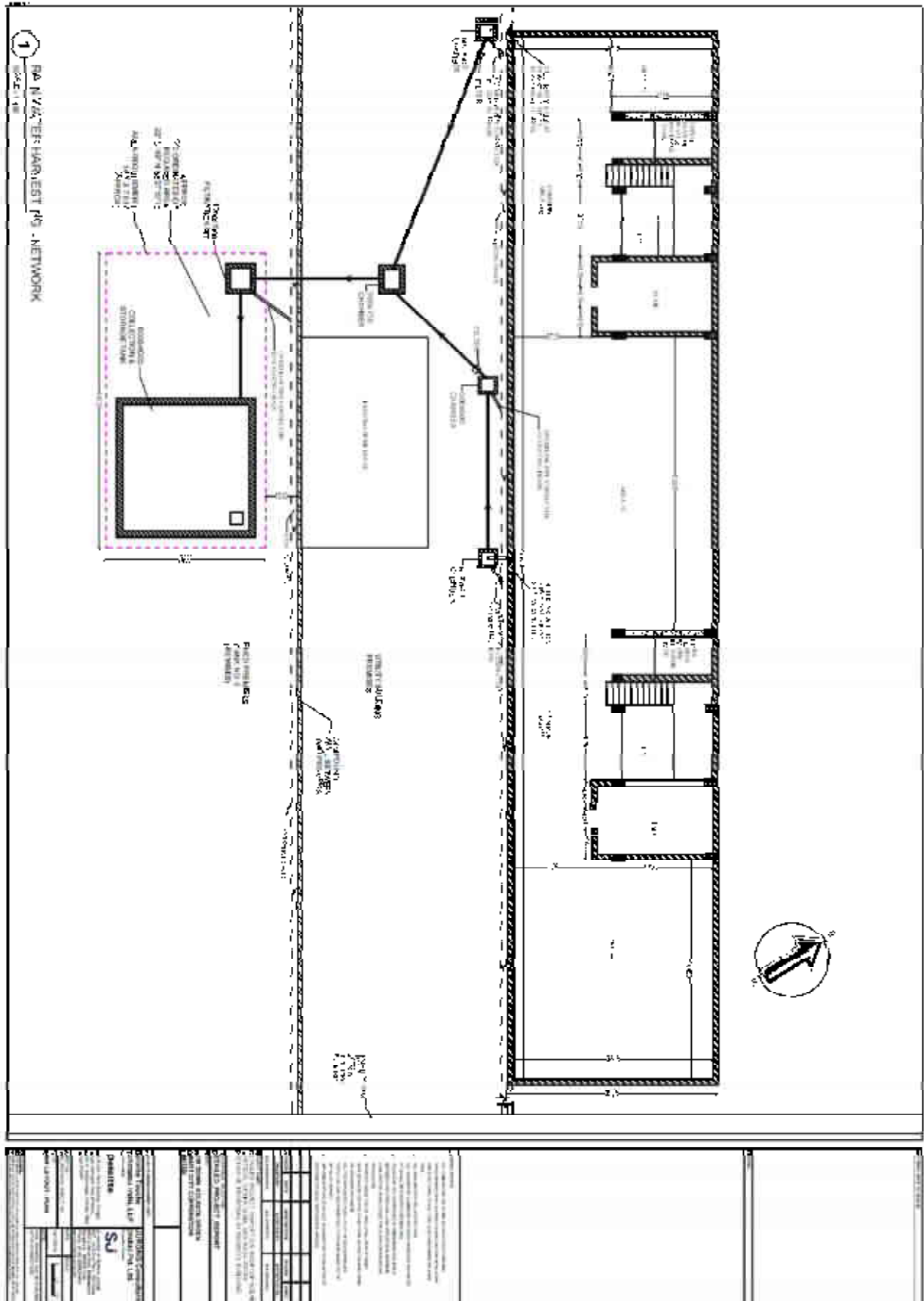
Proposed View 2
Source: NKDA

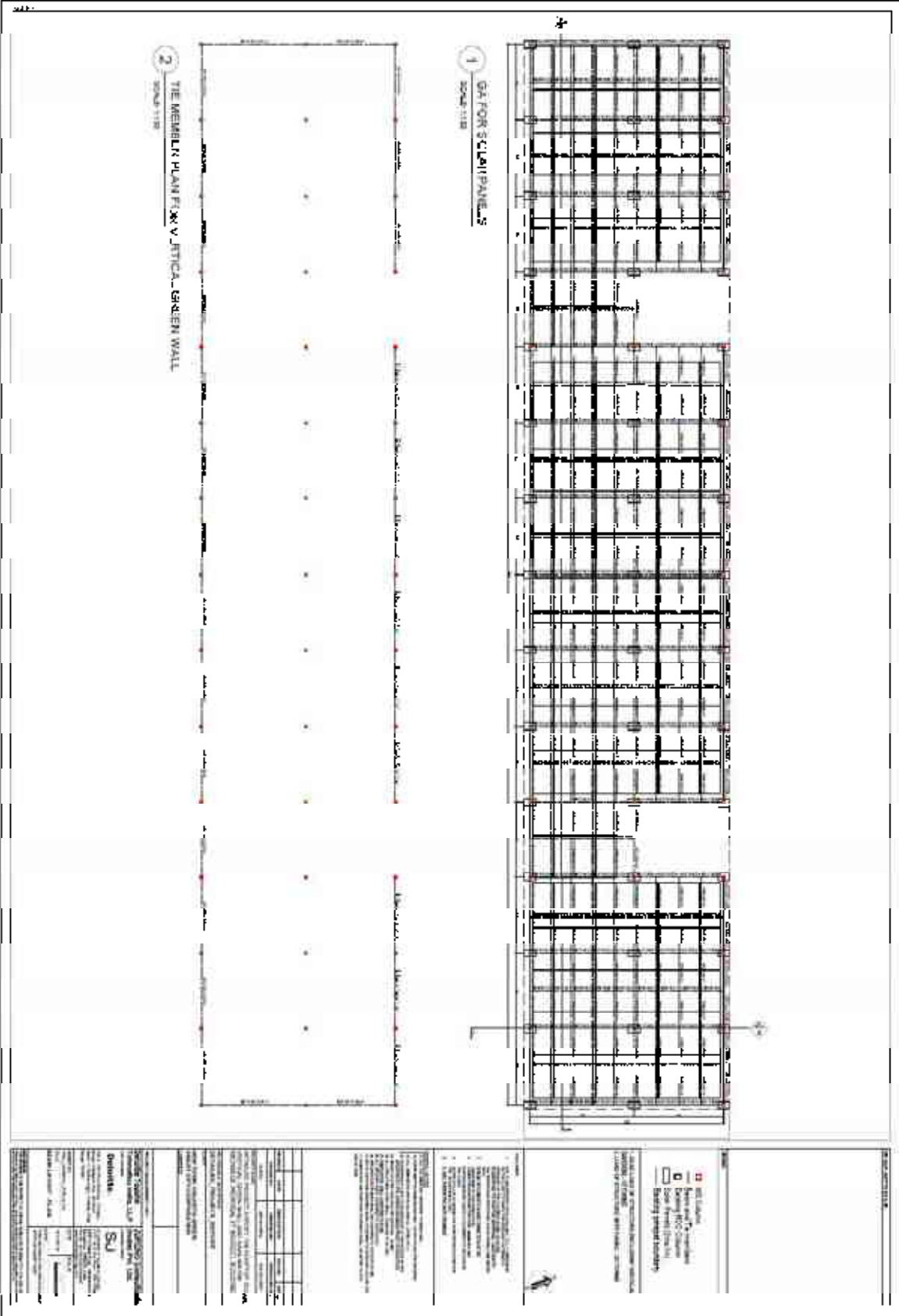


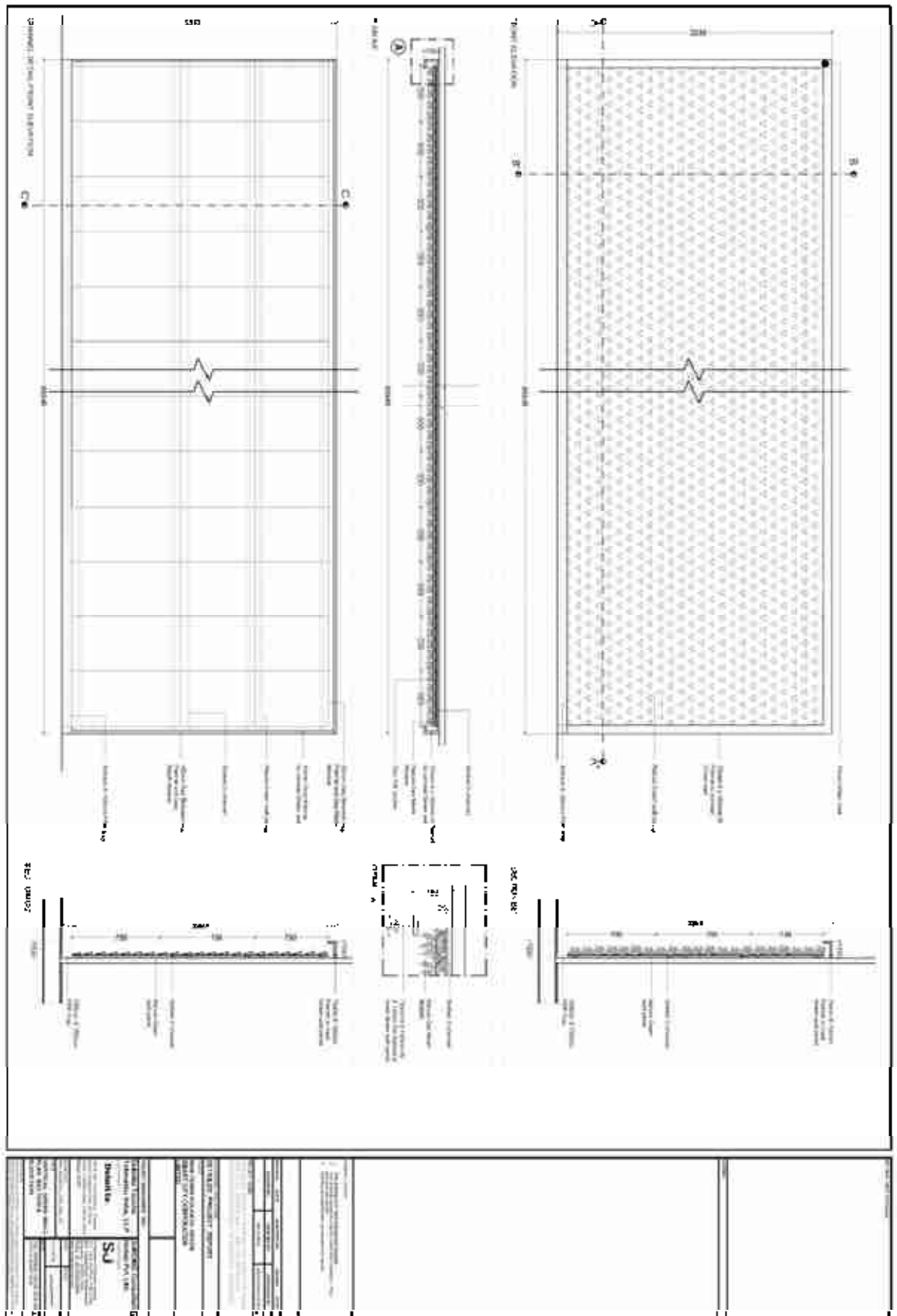
Proposed View 3
Source: NKDA



Proposed View 4
Source: NKDA







APPROVED MAKE LIST

Make List for Solar Roof top, Rain water Harvesting and Vertical Garden		
Sl No.	Description of Item	Approved Make / Brand
	Civil works	
1	Reinforcement for concrete works	SAIL/TATA/RINL
2	Paint	Berger/ Asian Paints/ ICICI/ Nerolac
3	MS structural works	SAIL/TISCO/UTKARSH
4	Galvanized corrugated sheets	TATA/Esar/Jindal
5	Controlled cement concrete M25 Garde	As per direction of EIC
6	RMC M25 grade	Ultratech/LnT/FTC
7	Anti-termite chemical	As approved by EIC
8	Water proofing chemical /compound	Sika / Dr Fixit/ Fosroc
9	White cement	Ultratec/Birla/ACC
10	cement 53 grade	Ultratech/Ambuja /ACC
12	Interlocking pavers /Concrete Kerb/RCC manhole covers	Pavestone/Calstone/GK Precast/ Advance precast/ S G Poly Concrete.
13	Outdoor vitrified Pavers/Tiles	H&R Johnson/Pavit/Ultra Pavers
14	Poly carbonate sheet	Bare Galvalume / Danpalon / GWX or Equivalent
15	Stainless steel	SAIL/TATA/RINL
16	Aluminum doors, windows & partition	Jindal/ Indian Aluminum Sections or Equivalent.
17	UpVC Louver windows	Supreme/Duroplast/ Promiplast
18	Aluminium Composite Panel (ACP)	Aludecor/ Alstrong/ Timex Bond/ Alstone
	PHE / Water supply	
1	Galvanized iron pipes	TATA/ Jindal Hissar/ JSW or equivalent
2	CPVC pipes & accessories	Supreme/Prince/Garware/Finolex/ Astral/Kissan or Equivalent.
3	UPVC pipes & accessories	Supreme/ Prince/Garware/Finolex/ Astral/Kissan orEquivalent.
4	Cast Iron Pipe	As approved By EIC
5	orange colour safety foot rest of minimum 6 mm thick plastic encapsulated as per IS : 10910,	As approved By EIC

Make List for Solar Roof top, Rain water Harvesting and Vertical Garden		
Sl No.	Description of Item	Approved Make / Brand
6	Rain water Harvesting filter	Jain/Alfa/RainBird
7	Submersible Pump	Kirloskar/V-Guard/Jindal
8	Sluice valve	Flowtech/calsens/Venus
	SOLAR	
1	Solar panel with accessories all complete	Vikram/Tata Solar/Luminous
1	Vertical Green Wall	ZTC/Rainbird/ sai entrprieses
	Electrical	
1	Lights, Cables, Switch Boards, DB, MCB, conduits, all other fittings and accessories.	Legrand/Schneider/ Seimens/ABB/L&T/Havells/CG/Almonard/Philips/Bajaj/Wipro

Executive Engineer IV
New Town Kolkata Development Authority

Signature Not Verified

Digitally signed by SANDEEP GANGULY
Date: 2019.12.26 15:48:02 IST
Location: West Bengal
Page 36 of 36