URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT (PRIVATE) LIMITED

AUGUST 2024

BIDDING DOCUMENT

(Drafted as per PPRA SBD)

SUPPLY, INSTALLATION, TESTING, COMMISSIONING OF 35 ROOFTOP RAINWATER HARVESTING SYSTEM IN MURREE MC

(SINGLE STAGE ONE ENVELOPE)

Procurement Reference No. UU/2024-25/06

Bidder's Signature & Stamp

Disclaimer

1. The information contained in this Bidding Document or subsequently provided to Bidder(s), whether verbally or in written form by or on behalf of the Urban Sector Planning and Management Services Unit (Private) Limited (The Urban Unit), or any of their employees or advisors, shall be subject to the terms and conditions set out in this Bidding Document and any other terms and conditions subject to which such information is provided.

2. This Bidding Document does not purport to contain all the information each Bidder may require. This Bidding Document may not be appropriate for all persons, and it is not possible for The Urban Unit, their employees or advisors to consider the investment objectives, financial situation and particular needs of each Bidder who reads or uses this Bidding Document. Certain Bidders may have better knowledge of the proposed Project than others may. Each Bidder should conduct its own investigations and analysis and should check the accuracy, reliability and completeness of the information in this Bidding Document and obtain independent advice from appropriate sources. The Urban Unit, its Representatives, their employees and advisors make no representation or warranty and shall incur no liability under any law, statute, rules or regulations as to the accuracy, reliability or completeness of the Bidding Document.

3. The Urban Unit may, in their absolute discretion, but without being under any obligation to do so, update, amend, add to any or all of the provisions or supplement the information of this Bidding Document or cancel the present Invitation and call for fresh Invitations. Such changes would be intimated to all Bidders using this Bidding Document.

4. The Urban Unit reserves the right to reject any or all of Bids submitted in response to this Invitation at any stage without assigning any reasons whatsoever before acceptance of any bid. The Urban Unit also reserves the right to hold or withdraw from or cancel the process at any stage up to the final pre-qualification / shortlisting / selection.

5. Neither the Urban Unit nor their employees or representative will have any liability in case of non-receipt of any correspondence from them to the bidders due to the postal delays.

6. Mere submission of this Bid or Pre-qualification or issue of RFP does not vest any right in the Bidder for being selected for the project.

7. All the procurement procedures shall be conducted in accordance with Punjab Procurement Authority Act-2009 and Punjab Procurement Rules-2014. In case of any conflict between the provision of this document and PPRA Act-2009/ PPRA Rules-2014, the latter shall prevail.

Bidder's Signature & Stamp

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1.1 INVITATION TO BIDS

Procurement Reference No. UU/2024-25/06

SUPPLY, INSTALLATION, TESTING, COMMISSIONING OF 35 ROOFTOP RAINWATER HARVESTING SYSTEM IN MURREE MC

(Funded by the Government of Punjab ADP CM Package for Murree)

MUREE RAINWATER HARVESTING PROJECT

The Urban Sector Planning and Management Services Unit Pvt. Limited is inviting sealed bids under the Single Stage Single Envelope bidding procedure from eligible sole proprietors/ firms/ companies/ constructors or contracting firms qualifying eligibility criteria and registered with the Federal Board of Revenue (FBR) and Income Tax and Punjab Revenue Authority (PRA) Department. The procurement title is " *SUPPLY, INSTALLATION, TESTING, COMMISSIONING OF 35 ROOFTOP RAINWATER HARVESTING SYSTEM IN MURREE MC*" and will be conducted in accordance with the Punjab Procurement Rules 2014.

In this phase, complete Rainwater Harvesting Systems (RWH) are to be installed for approximately 35 houses/residential units of low-income 3, 4, and 5 Marla houses in Murree MC area including Government Buildings & Girls Schools as identified by the client. The contractor is expected to start the mobilization & site execution of the awarded work in August 2024. The details of the Project requirement are described as follows.

Sr.	Project Scope & Description / Numbers	Estimated Cost in Millions (PKR)
1.	Rainwater Harvesting Systems for 3 Marla Houses – 11 Nos	3.2
2.	Rainwater Harvesting Systems for 4 Marla Houses – 12 Nos	3.97
3.	Rainwater Harvesting Systems for 5 Marla Houses – 7 Nos	3.31
4.	Rainwater Harvesting Systems for Govt Buildings – 5 Nos	2.47
5.	MIS System	2.03
	Total Cost of Project	**15**

ELIGIBILITY CRITERIA

- The interested bidders must be registered with PEC in the category C-6 or above with valid registration certificates
- Bidders must have completed and/or substantial projects related to water supply or of similar nature and complexity as main contractor with the value of Rupees 25 million during the last five years with any authority or government or private sector along with authenticated proof including letter of award and completion certificate.
- Valid NTN certificate as taxpayer with FBR shall also be required
- Average annual construction turnover of the last three years must be 50 million.
- The bidders must enclose the bid security of amount PKR 450,000/- (3% of the estimated cost of PKR15 million) in favor of The Urban Sector Planning and Management Services Unit Pvt. Ltd.

Bidder's Signature & Stamp

- The complete bidding document, which includes detailed specifications and terms & conditions, will be made available upon payment of the required fees as mentioned in the advertisement. Interested parties wishing to obtain the bidding document must submit a written request on their official letterhead. This request must be submitted along with a payment slip for ***PKR 2000 (non-refundable),*** which must be deposited in ***The Bank of Punjab, Account No. 6580003315500019, Egerton Road Branch, Branch Code 0002***. Please ensure that the payment is made in accordance with the specified instructions, as no document will be issued without the receipt of the full payment. The deadline for submitting bids is of 26th August 2024 till 12:00 P.M. The bid opening will take place at 12:30 P.M. on the same day at the address provided below, and bidders or their authorized representatives are welcome to attend.

For any inquiries or clarifications, feel free to reach out to the procurement department.

Senior Procurement Manager
The Urban Unit
503 – Shaheen Complex, Egerton Road, Lahore
Ph: 042-99205316-22
Fax: 042-99205323
www.urbanunit.gov.pk

Bidder's Signature & Stamp

Section-II: Instructions to Bidders (ITB)

Note: *All the procurement procedures shall be conducted in accordance with Punjab Procurement Authority Act-2009 and Punjab Procurement Rules-2014. In case of any conflict between the provision of this document and PPRA Act-2009/ PPRA Rules-2014, the latter shall prevail.*

2.1. Introduction

2.1.1 Scope of Bid	i) The Procuring Agency (PA), as indicated in the Bid Data Sheet (BDS) invites Bids for the provision of Goods as specified in the Section-IV Bid Data Sheet (BDS) and Section III - Technical Specifications & Section VII- Schedule of Requirements. The successful Bidders will be expected to procure, install, test, commission & maintain the goods within the specified period and timeline(s) as stated in the BDS.
2.1.2 Source of Funds	i) The Procuring Agency named in the Bid Data Sheet has received a budget from the Government of Punjab (Funded by the ADP CM Package for Murree). The Procuring Agency intends to apply the provided funds/ a portion of this budget to make eligible payments under the contract for which the Invitation to bids has been issued.
2.1.3 Eligible Bidders	i) The Invitation to Bids is open to all suppliers i.e. association of firms/companies/sole proprietor/ general order suppliers/ JVs, registered with relevant Registration Authorities and Tax Departments/ Authorities (Income Tax, Sales Tax & Punjab Sales Tax etc.), except as provided hereinafter. ii) Bidders should not be associated, or have been associated in the past, directly or indirectly, with a firm or any of its affiliates which have been engaged by the Procuring Agency to provide consultancy services for the preparation of the design, specifications, and other documents to be used for the procurement of the goods to be purchased under this Invitation to Bids. iii) Government-owned enterprises may participate only if they are duly/legally authorized in this regard by the respective/relevant competent forum/authority. iv) Bidders shall not be under a declaration of blacklisting by the Procuring Agency.

	v) In the case of a Joint Venture, Consortium, or Association, all members shall be jointly and severally liable for the execution of the Contract in accordance with the terms and conditions of the Contract. The limit on the number of members of a JV or Consortium or Association is two. The Joint Venture, Consortium, or Association shall nominate a Lead Member as nominated in the BDS, who shall have the authority to conduct all business for and on behalf of any and all the members of the joint venture, consortium, or association during the Bidding process, and in case of award of contract, during the execution of contract. vi) The appointment of Lead Member in the Joint Venture, Consortium, or Association shall be confirmed by submission of a valid JV or Consortium agreement to the Procuring Agency. vii) Any agreement that forms a Joint Venture, Consortium or Association shall be required to be submitted as part of the Bid and shall be attested. viii) Any bid submitted by the Joint Venture, Consortium or Association shall indicate the part of proposed contract to be performed by each party and each party shall be evaluated or post qualified with respect to its contribution only and the responsibilities of each party and shall not be substantially altered without prior written approval of the Procuring Agency and in line with any instructions issued by the Authority. ix) The invitation for Bids is open to all prospective Supplier, Manufacturers or Authorized Agents/Dealers/Distributors subject to any provisions or licensing/regulatory requirements issued by the respective National/ Provincial Professional Statutory Body established for that particular trade or business as mentioned in the bid data sheet. x) A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be Non-Responsive. A Bidder may be considered to have a conflict of interest with one or more parties in this bidding process, if they: a) Are associated or have been associated for the procurement of the goods to be purchased under this Invitation for Bids, directly or indirectly with a firm or any of its affiliates which have been engaged by the Procuring Agency to provide consulting services for the preparation of the design, specifications and other documents to be used. b) Have controlling shareholders in common; or

	c) Receive or have received any direct or indirect subsidy from any of them; or d) Have the same legal representative for purposes of this Bid; or e) Have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder, or influence the decisions of the Procuring Agency regarding this Bidding process; or xii) A Bidder may be ineligible if – (a) The Bidder is declared bankrupt or, in the case of company or firm, insolvent; (b) Payments in favor of the Bidder is suspended in accordance with the judgment of a court of law other than a judgment declaring bankruptcy and resulting, in accordance with the national laws, in the total or partial loss of the right to administer and dispose of its property; (c) Legal proceedings are established against such Bidder involving an order suspending payments and which may result, in accordance with the national laws, in a declaration of bankruptcy or in any other situation entailing the total or partial loss of the right to administer and dispose of the property; (d) The Bidder is convicted, by a final judgment, of any offense involving professional conduct; (e) The Bidder is debarred and blacklisted due to involvement in corrupt and fraudulent practices in accordance with the provision of section 17A of PPRA Act, 2009 and Rule-21, read with Schedule appended with, Punjab Procurement Rules, 2014. (f) The Bidder is debarred and blacklisted in general (i.e. to the extent of all public procurement) due to consistent performance failure in accordance with the section 17A of PPRA Act, 2009 and Rule-21, read with Schedule appended with, Punjab Procurement Rules, 2014.

	(g) The firm, supplier and contractor is blacklisted/ debarred by any international organization. xiii) Bidders shall provide to the Procuring Agency evidence of their eligibility, proof of compliance with the necessary legal requirements to carry out the contract effectively. xiv) Bidders shall provide such evidence of their continued eligibility satisfactory to the Procuring Agency, as the Procuring Agency shall reasonably request. xv) Bidders shall submit proposals relating to the nature, conditions and modalities of sub-contracting wherever the sub-contracting of any elements of the contract amounting to more than ten percent of the Bid price is envisaged.
2.1.4. Eligible Goods and Services	i) All goods and related services to be supplied under the Contract shall have their origin in eligible source countries, defined in the Technical Specification, and all expenditures made under the contract will be limited to such goods and related services. ii) For purposes of this clause, "origin" means the place where the goods are mined, grown, or produced, or the place from which the related services are supplied. Goods are produced when, through manufacturing, processing, or substantial and major assembly of components, a commercially-recognized product is obtained that is substantially different in basic characteristics or in purpose or utility from its components. iii) The origin of goods and services is distinct from the nationality of the Bidder. *In any case, the requirements of Rules 10 & 26 of PPR-14, shall be followed.*
2.1.5. Cost of Bidding	i) The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Procuring Agency named in the Bid Data Sheet, hereinafter referred to as "the Procuring Agency," will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the Bidding process.
2.1.6. One person one bid	i) As per Rule 36A of Punjab Procurement Rules 2014, a Bidder shall submit only one Bid in the same bidding process, either individually as a Bidder or as a member in a joint venture or any similar arrangement.

	ii) No Bidder can be a sub-contractor while submitting a Bid individually or as a member of a joint venture in the same Bidding process. iii) A Bidder, if acting in the capacity of sub-contractor in any Bid, shall not submit a bid for the same.

2.2. The Bidding Documents

2.2.1. Content of Bidding Documents	i) The goods required, Bidding procedures, and contract terms are prescribed in the Bidding documents. The Bidding documents, inter alia, include: (a) Invitation to Bids (b) Instructions to Bidders (ITB) (c) Technical Specifications (d) Bid Data Sheet (e) General Conditions of Contract (GCC) (f) Special Conditions of Contract (SCC) (g) Schedule of Requirements (h) Bid Form (i) Manufacturer's Authorization Form (j) Bidder Profile Form (k) General Information Form (l) Affidavit (m) Bid Security Form (n) Technical Bid Form (o) Contract Form (p) Financial Bid Form / Price Schedule (q) Performance Guarantee Form (r) Check List

	ii) The Bidder is required to examine all instructions, forms, terms, and specifications in the Bidding documents. Failure to furnish all information as required by the Bidding documents or to submit a Bid not responsive to the Bidding documents in every respect will be at the Bidder's risk and may result in the rejection of its Bid. iii) In case of discrepancies between the Invitation to Bid and the Bidding Documents listed in **ITB 2.2.1 (i)** above, the said Bidding Documents, not in conflict with any provision of PPR-14, will take precedence. iv) The Procuring Agency is not responsible for the completeness of the Bidding Documents and their addenda, if they were not obtained directly from the Procuring Agency or from its website or website of PPRA. Re-confirming from the Procuring Agency that all pages/ contents have been properly and clearly received is the prime responsibility of the Bidder.
2.2.2. Clarification of Bidding Documents	i) A prospective Bidder requiring any clarification of the Bidding documents may notify the Procuring Agency in writing or by email at the Procuring Agency's address indicated in Invitation to Bid/ Tender Notice/ Advertisement. The Procuring Agency will respond in writing to any request for clarification of the Bidding documents which it receives no later than seven (7) days prior to the deadline for the submission of Bids prescribed in the Bid Data Sheet. Written copies of the Procuring Agency's response (including an explanation of the query but without identifying) will be sent to all prospective Bidders that have received the Bidding documents. ii) A prospective Bidder requiring any clarification of the Bidding Documents may notify the Procuring Agency in writing or in electronic form that provides a record of the content of communication at the Procuring Agency's address indicated in the **BDS.** iii) The Procuring Agency will within three (3) working days after receiving the request for clarification, respond in writing or in electronic form to any request for clarification provided that such request is received not later than seven (7) days prior to the deadline for the submission of Bids. As prescribed in **ITB 2.2.2 (i), above.** However, this clause shall not apply in case of alternate methods of Procurement. iv) Copies of the Procuring Agency's response will be uploaded on the website of procuring agency on given date(__) and forwarded to identified Prospective Bidders through an expeditious identified source of communication, e.g.: e-mail etc., including a description of the inquiry, but without identifying its source.

	v) Should the Procuring Agency deem it necessary to amend the Bidding Documents as a result of a clarification, it shall do so following the procedure under **ITB 2.2.3.** vi) If indicated **in the BDS**, the Bidder's designated representative is invited at the Bidder's cost to attend a pre-Bid meeting at the place, date and time mentioned **in the BDS**. During this pre-Bid meeting, prospective Bidders may request clarification of the schedule of requirement, the Evaluation Criteria or any other aspects of the Bidding Documents. vii) Minutes of the pre-Bid meeting, if applicable, including the text of the questions asked by Bidders, including those during the meeting (without identifying the source) and the responses given, together with any responses prepared after the meeting will be transmitted promptly to all prospective Bidders who have obtained the Bidding Documents and by uploading same on the website of the procuring agency. Any modification to the Bidding Documents that may become necessary as a result of the pre-Bid meeting shall be made by the Procuring Agency exclusively through the use of an Addendum pursuant to ITB 2.2.3. Non-attendance at the pre-Bid meeting will not be a cause for disqualification of a Bidder.
2.2.3. Amendment of Bidding Documents	i) At any time prior to the deadline for submission of Bids, but not later than three (3) days before the closing date of the submission of Bid, the Procuring Agency, for any reason, whether at its own initiative or in response to a clarification requested by a prospective Bidder, may modify the Bidding documents by amendment. Any such change/amendment in the Bidding documents shall be provided in a timely manner, preferably through electronic means also, not later than three (3) days, and on equal opportunity basis as per Rule-25(3) OR Rule 25(4) of PPR-14 as the case may be. ii) In order to allow prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Procuring Agency, at its discretion, may extend the deadline for the submission of Bids, as per rule 29 of PPR-14, in the manner similar to the original advertisements, so as to avoid any inconvenience and to doubly ensure level playing field for all prospective bidders.

2.3. Preparation of Bids

2.3.1. Language of Bid	i) The Bid prepared by the Bidder, as well as all correspondence and documents relating to the Bid exchanged by the Bidder and the Procuring Agency shall be written in the language specified in the

	Bid Data Sheet. Supporting documents and printed literature furnished by the Bidder may be in the same language.
2.3.2. Bid Form	i) The Bidder shall complete the Bid Form and the appropriate Price Schedule (Financial Bid) furnished in the Bidding documents, indicating the goods to be supplied, a brief description of the goods, their country of origin, quantity, installation mechanism, maintenance plan and prices.
2.3.3. Bid Prices	i) The Bidder shall indicate on form 8.10 the unit prices (where applicable) and total Bid price of the goods it proposes to supply under the contract. ii) Prices indicated on the Price Schedule shall be item wise/ package wise ***[to be decided by the Procuring Agency on form 8.10]*** iii) The Bidder's separation of price components in accordance with ITB Clause 2.3.3(ii) above will be solely for the purpose of facilitating the comparison of Bids by the Procuring Agency and will not in any way limit the Procuring Agency's right to contract on any of the terms offered. iv) Prices quoted by the Bidder shall be fixed during the Bidder's performance of the contract and not subject to variation on any account, unless otherwise specified in the Bid Data Sheet. A Bid submitted with an **adjustable price quotation** will be treated as non-responsive and may be rejected.
2.3.4. Bid Currencies	i) Prices shall be quoted in **Pak Rupees** for local/DDP items unless otherwise specified in the Bid Data Sheet.
2.3.5. Documents Establishing Bidder's Eligibility and Qualification	i) Pursuant to ITB Clause 2.1.3, the Bidder shall furnish, as part of its Bid, documents establishing the Bidder's eligibility to Bid and its qualifications to perform the contract if its Bid is accepted. ii) The documentary evidence of the Bidder's eligibility to Bid shall establish to the Procuring Agency's satisfaction that the Bidder, at the time of submission of its Bid, is eligible as defined under ITB Clause 2.1.3.

	iii) The documentary evidence, of the Bidder's qualifications to perform the contract if its Bid is accepted, shall establish to the Procuring Agency's satisfaction: (a) that, in the case of a Bidder offering to supply goods under the contract which the Bidder did not manufacture or otherwise produce, the Bidder has been duly authorized by the goods' Manufacturer *[Manufacturer's Authorization form No. 8.3]* or producer to supply the same in Pakistan; (b) that the Bidder has the financial, technical, and production capability necessary to perform the contract; (c) that, in the case of a Bidder not doing business within Pakistan, the Bidder is or will be (if awarded the contract) represented by an Agent in that country equipped, and able to carry out the Supplier's maintenance, repair, and spare parts-stocking obligations prescribed in the Conditions of Contract and/or Technical Specifications; and (d) that the Bidder meets the qualification criteria listed in the Bid Data Sheet.
2.3.6. Documents Establishing Goods' Eligibility and Conformity to Bidding Documents	i) Pursuant to ITB Clause 2.1.4, the Bidder shall furnish, as part of its Bid, documents establishing the eligibility and conformity to the Bidding documents of all goods and related services which the Bidder proposes to supply under the contract. ii) The documentary evidence of the eligibility of the goods and services shall consist of a statement in the Price Schedule/Financial Bid Form of the country of origin of the goods and services offered which shall be confirmed by a **Certificate of Origin** issued at the time of shipment. iii) The documentary evidence of conformity of the goods and services to the Bidding documents may be in the form of literature, drawings, data and shall consist of: (a) a detailed description of the essential technical and performance characteristics of the goods; (b) a list giving full particulars, including available sources and current prices of spare parts, special tools, etc., necessary for the proper and continuing functioning of the goods for a period to be specified in the Bid Data Sheet, following commencement of the use of the goods by the Procuring Agency; and

	(c) an item-by-item commentary on the Procuring Agency's Technical Specifications demonstrating **responsiveness** of the goods and services to those specifications, or a statement of deviations and exceptions to the provisions of the Technical Specifications. iv) For purposes of the commentary to be furnished, the Bidder shall note that standards for workmanship, material, and equipment, as well as references to brand names or catalog numbers designated by the Procuring Agency in its Technical Specifications, are intended to be descriptive only and not restrictive. v) Where a sample(s) is required by a procuring agency, the sample shall be: (a) submitted as part of the bid, in the quantities, dimensions and other details requested in the **BDS**; (b) carriage paid; (c) received on, or before, the closing time and date for the submission of bids; and (d) Evaluated to determine compliance with all characteristics listed in the **BDS**. (e) However, the procuring agency may also opt to ask for samples after submission of technical bids (where required) vi) The Procuring Agency may retain the sample(s) of the successful Bidder till the successful delivery of the goods. A Procuring Agency may reject the Bid if the sample(s)- (a) do(es) not conform to all characteristics prescribed in the bidding documents; and (b) is/are not submitted within the specified time clearly mentioned in the Bid Data Sheet. vii) Where it is not possible to avoid using a propriety article as a sample, a Bidder shall make it clear that the propriety article is displayed only as an example of the type or quality of the goods being Bided for, and that competition shall not thereby be limited to the extent of that article only. viii) Samples made up from materials supplied by a Procuring Agency shall not be returned to a Bidder nor shall a Procuring Agency be liable for the cost of making them. ix) All samples produced from materials belonging to an unsuccessful Bidder may be kept by the Procuring Agency till thirty (30) days from the date of award of contract or exhaustion of all the grievance

	forums (including those pending at Authority's Level or in some Court of Law). x) **Pursuant to** the requirements as indicated in ITB 2.3.6**, the Bidder shall furnish, as part of its Bid, all those documents establishing the eligibility in conformity to the terms and conditions specified in the Bidding Documents for all goods and related services which the Bidder proposes to deliver.** xi) The Bidder shall also furnish a list giving full particulars, including available sources and current prices of goods, spare parts, special tools, etc., necessary for the proper and continuing functioning of the Goods during the period **specified in the BDS** following commencement of the use of the goods by the Procuring Agency. xii) The required documents and other accompanying documents must be in English. In case any other language than English is used the pertinent translation attested by the embassy in the country of manufacturer into English shall be attached to the original version.
2.3.7. Bid Security	i) The Bidder shall furnish, as part of its Bid, a Bid security in the amount specified in the Bid Data Sheet. ii) The Bid security is required to protect the Procuring Agency against the risk of Bidder's conduct which would warrant the security's forfeiture Pursuant to ITB Clause 2.3.8. (vii). iii) The Bid security shall be in Pakistan Rupees and shall be in one of the following forms: *(a)* Bank Guarantee, Bank call-deposit (CDR), Demand Draft (DD), Pay Order (PO) or Banker's cheque valid for 120 days. iv) Any Bid not secured in accordance with ITB Clauses 2.3.8 (i) and (ii) may be rejected by the Procuring Agency as non-responsive. v) Unsuccessful Bidders' Bid security will be discharged or returned as promptly as possible but not later than 120 days. vi) The successful Bidder's Bid security will be discharged upon the Bidder signing the contract, pursuant to ITB Clause 2.6.1, and furnishing the Performance Guarantee, pursuant to ITB Clause 2.6.2. vii) The Bid security may be forfeited: a. If a Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Bid Form; or

	b. In the case of a successful Bidder, if the Bidder: i. Fails to sign the contract in accordance with ITB Clause 2.6.3; **or** ii. Fails to furnish Performance Guarantee in accordance with ITB Clause 2.6.2; or iii. If the blacklisting proceedings under Section-17A of PPRA Act, 2009 read with Rule-21 of PPR-14 are initiated and the bidder is declared blacklisted after due process of law.
2.3.8. Period of Validity of Bids	i) Bids shall remain valid for the period specified in the Bid Data Sheet after the date of Bid opening prescribed by the Procuring Agency. A Bid valid for a shorter period may be rejected by the Procuring Agency as non-responsive. ii) In exceptional circumstances, the Procuring Agency may solicit the Bidder's consent to an extension of the period of validity (as per rule-28 of PPR-14). The request and the responses thereto shall be made in writing (or by email). The Bid security provided under ITB Clause 2.3.8 shall also be suitably extended. A Bidder may refuse the request without forfeiting its Bid security. A Bidder accepting the request will not be required nor permitted to modify its Bid.
2.3.9. Format and Signing of Bid	i) The Bidder shall prepare an original and the five (05) number of copies of the Bid indicated in the Bid Data Sheet, clearly marking each "ORIGINAL BID" and "COPY OF BID," as appropriate. In the event of any discrepancy between them, the original shall prevail. ii) The Bidder shall authorize a person/ persons for signing, submission and further correspondence with the Procuring Agency on behalf of the bidder. Authority letter must be part of the bid. However, in case of any issue the bidder shall be responsible for all consequences. iii) The original and the copy or copies of the Bid shall be typed or written in indelible ink and shall be signed by the Bidder or a person duly authorized to bind the Bidder to the contract. All pages of the Bid, shall be signed and stamped by the authorized person. iv) Any interlineation, erasures, or overwriting shall be valid only if they are initialed by the authorized person for signing the Bid. v) The original and the copy or copies of the Bid shall be typed or written in indelible ink and shall be signed by the Bidder or a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written confirmation as specified in the **BDS** and

	shall be attached to the Bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid, shall be signed and stamped by the authorized person. vi) Any interlineations, erasures, or overwriting shall be valid only if they are signed by the person or persons signing the Bidder. vii) The Bidder shall furnish information as described in the Form of Bid on commissions or gratuities, if any, paid or to be paid to agents relating to this Bid and to contract execution if the Bidder is awarded the contract.

2.4. Submission of Bids

2.4.1 Sealing and Marking of Bids	i) As per Rule 24, the Bidder shall seal the original and each copy of the Bid in separate envelopes, duly marking the envelopes as "ORIGINAL" and "COPY." The envelopes shall then be sealed in an outer envelope. ii) The inner and outer envelopes shall: a. be addressed to the Procuring Agency at the address given in the Bid Data Sheet; and b. bear the title of procurement Activity indicated in the Bid Data Sheet, the Invitation to Bids (ITB) title and number indicated in the Bid Data Sheet, and a statement: "DO NOT OPEN BEFORE….. (time and date)," *[to be completed with the time and the date specified in the Bid Data Sheet, pursuant to ITB Clause 2.4.2.]* iii) The inner envelopes shall also indicate the name and address of the Bidder to enable the Bid to be returned unopened in case it is declared "late". iv) If the outer envelope is not sealed and marked as required by ITB Clause 2.4.1 (i), the Procuring Agency will assume no responsibility for the Bid's misplacement or premature opening. v) In case of Single Stage One Envelope Procedure, the Bidder shall seal the original and each copy of the Bid in separate envelopes, duly marking the envelopes as "ORIGINAL" and "COPY." The envelopes shall then be sealed in an outer envelope securely sealed in such a manner that opening and resealing cannot be achieved undetected. **Note:** The envelopes shall be sealed and marked in accordance with the bidding procedure adopted as referred in Rule-38 of PPR-2014, which shall have precedence. vi) The inner and outer envelopes shall:

	a) Be addressed to the Procuring Agency at the address given in the **BDS**; and b) Bear the title of the subject procurement or Project name, as the case may be as indicated in the **BDS**, the Invitation to Bids (ITB) title and number indicated in the **BDS**, and a statement: "DO NOT OPEN BEFORE," to be completed with the time and the date specified in the **BDS**, pursuant to **ITB 2.4.2.** vii) In case of Single Stage Two Envelope Procedure, The Bid shall comprise two envelopes submitted simultaneously, one called the Technical Proposal and the other Financial Proposal. Both envelopes to be enclosed together in an outer single envelope called the Bid. Each Bidder shall submit his bid as under: a) Bidder shall submit his TECHNICAL PROPOSAL and FINANCIAL PROPOSAL in separate inner envelopes and enclosed in a single outer envelope. b) ORIGINAL and each copy of the Bid shall be separately sealed and put in separate envelopes and marked as such. (c) The envelopes containing the ORIGINAL and copies will be put in one sealed envelope and addressed / identified as given in BDS. viii) The inner and outer envelopes shall: a) be addressed to the Procuring Agency at the address provided in the BDS; b) bear the name and identification number of the contract as defined in the BDS; and provide a warning not to open before the time and date for bid opening, as specified in the BDS, pursuant to ITB 2.4.2; c) In addition to the identification required in Sub- Clause (b) hereof, the inner envelope shall indicate the name and address of the Bidder to enable the bid to be returned unopened in case it is declared "late" pursuant to ITB.2.4.3. ix) If all envelopes are not sealed and marked as required by **ITB 2.4.1** or incorrectly marked, the Procuring Agency will assume no responsibility for the misplacement or premature opening of Bid.
2.4.2 Deadline for Submission of Bids	i) Bids must be received by the Procuring Agency at the address specified under BDS no later than the time and date specified in the Bid Data Sheet. Bids received through courier services shall not be entertained.

	ii) The Procuring Agency may, at its discretion and as per rule 29 of PPR-14, extend this deadline for the submission of Bids by amending the Bidding documents in accordance with ITB Clause 2.2.2 & 2.2.3 in which case all rights and obligations of the Procuring Agency and Bidders previously subject to the deadline will thereafter be subject to the deadline as extended. iii) Bids shall be received by the Procuring Agency at the address specified under **BDS** no later than the date and time specified in the **BDS.**
2.4.3. Late Bids	i) Any Bid received by the Procuring Agency after the deadline for submission of Bids prescribed by the Procuring Agency pursuant to ITB Clause 2.4.2 will be rejected and returned unopened to the Bidder. ii) The Procuring Agency shall not consider for evaluation any Bid that arrives after the deadline for submission of Bids. iii) Any Bid received by the Procuring Agency after the deadline for submission of Bids shall be declared late, recorded, rejected and returned unopened to the Bidder.
2.4.4. Modification and Withdrawal of Bids	i) The Bidder may modify or withdraw its Bid after the Bid's submission, provided that written notice of the modification, including substitution or withdrawal of the Bids, is received by the Procuring Agency prior to the deadline prescribed for submission of Bids. ii) The Bidder's modification or withdrawal notice shall be prepared, sealed, marked, and dispatched in accordance with the provisions of Clause (i) A withdrawal notice may also be sent by email, but followed by a signed confirmation copy, postmarked not later than the deadline for submission of Bids. iii) No Bid may be modified after the deadline for submission of Bids. iv) No Bid may be withdrawn in the interval between the deadline for submission of Bids and the expiration of the period of Bid validity specified by the Bidder on the Bid Form. Withdrawal of a Bid during this interval may result in the Bidder's forfeiture of its Bid security (along with other remedies available under PPR-14), pursuant to the ITB Clause 2.3.8 (vii). v) A Bidder may withdraw its Bid after it has been submitted, provided that written notice of the withdrawal of the Bid, is received by the Procuring Agency prior to the deadline for submission of Bids.

	vi) Revised bid may be submitted after the withdrawal of the original bid before the deadline for submission of Bids.

2.5. Opening and Evaluation of Bids

2.5.1. Opening of Bids by the Procuring Agency	i) The Procuring Agency will open all Bids, in public, in the presence of Bidders' or their representatives who choose to attend, and other parties with a legitimate interest in the Bid proceedings at the place, on the date and at the time, specified in the **BDS**. The Bidders' representatives present shall sign a register/attendance sheet as proof of their attendance. ii) First, envelopes marked "WITHDRAWAL" shall be opened and read out and the envelope with the corresponding bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding Withdrawal Notice contains a valid authorization to request the withdrawal and is read out at bid opening. iii) Second, outer envelopes marked "SUBSTITUTION" shall be opened. The inner envelopes containing the Substitution Bid shall be exchanged for the corresponding Original Bid being substituted, which is to be returned to the Bidder unopened. No envelope shall be substituted unless the corresponding Substitution Notice contains a valid authorization to request the substitution and is read out and recorded at bid opening. iv) Next, outer envelopes marked "MODIFICATION" shall be opened. No Technical Proposal and/or Financial Proposal shall be modified unless the corresponding Modification Notice contains a valid authorization to request the modification and is read out and recorded at the opening of the Bids. Any Modification shall be read out along with the Original Bid except in case of Single Stage Two Envelope Procedure where only the Technical Proposal, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Financial Proposal, both Original and Modification, will remain unopened till the prescribed financial bid opening date. v) Other envelopes holding the Bids shall be opened one at a time, in case of Single Stage One Envelope Procedure, the Bidders names, the Bid prices, the total amount of each Bid, the presence or absence of Bid Security, Bid Securing Declaration and such other details as

		the Procuring Agency may consider appropriate, will be announced by the Procurement Evaluation Committee. vi) In case of Single Stage Two Envelope Procedure, the Procuring Agency will open the Technical Proposals in public at the address, date and time specified in the **BDS** in the presence of Bidders` designated representatives who choose to attend and other parties with a legitimate interest in the Bid proceedings. The Financial Proposals will remain unopened and will be held in custody of the Procuring Agency until the specified time of their opening. vii) The envelopes holding the Technical Proposals shall be opened one at a time, and the following read out and recorded: (a) the name of the Bidder; (b) the presence of a Bid Security, if required; and (c) Any other details as the Procuring Agency may consider appropriate. viii) Bidders are advised to send in a representative with the knowledge of the content of the Bid who shall verify the information read out from the submitted documents. Failure to send a representative or to point out any un-read information by the sent Bidder's representative shall indemnify the Procuring Agency against any claim or failure to read out the correct information contained in the Bidder's Bid. ix) No Bid will be rejected at the time of Bid opening except for late Bids which will be returned unopened to the Bidder, pursuant to **2.4.3 (i).** x) The Procuring Agency shall prepare minutes of the Bid opening. The record of the Bid opening shall include, as a minimum: the name of the Bidder and whether or not there is a withdrawal, substitution or modification, the Bid price if applicable. xi) The Bidders' representatives who are present shall be requested to sign on the attendance sheet. The omission of a Bidder's signature on the record shall not invalidate the contents and affect the record. xii) Minutes of the Financial Bid Opening shall be recorded and uploaded by the procuring agency on its website or shared to all bidders through e-mail. *[if Procuring Agency opts for single stage one envelope procedure as per rule 38(1) of PPR-14, clause (vi) to (xiii) should be formulated accordingly by the procuring agency.]*
2.5.2. Confidentiality	i)	Information relating to the examination, clarification, evaluation and comparison of Bids and recommendation of contract award

	shall not be disclosed to Bidders or any other persons not officially concerned with such process until the time of the announcement of the respective evaluation report in accordance with the requirements of rule 37 of PPR-14. ii) Any effort by a Bidder to influence the Procuring Agency processing of Bids or award decisions may result in the rejection of its Bid. iii) Notwithstanding **ITB Clause 2.2.2** from the time of Bid opening to the time of contract award, if any Bidder wishes to contact the Procuring Agency on any matter related to the Bidding process, it should do so in writing or in electronic forms that provides record of the content of communication.
2.5.3. Clarification of Bids	i) As per rule 33(2) of PPR-14, to assist in the examination, evaluation and comparison of Bids and post-qualification of the Bidders, the Procuring Agency may, at its discretion, ask any Bidder for a clarification of its Bid including breakdown of prices to determine its reasonability. Any clarification submitted by a Bidder that is not in response to a request by the Procuring Agency shall not be considered. ii) The request for clarification and the response shall be in writing or in electronic forms that provide record of the content of communication. In case of Single Stage Two Envelope Procedure, no change in the prices or substance of the Bid shall be sought, offered, or permitted. Whereas in case of Single Stage One Envelope Procedure, only the correction of arithmetic errors discovered by the Procuring Agency in the evaluation of Bids should be sought in accordance with ITB Clause 2.5.6. iii) The alteration or modification in The Bid which in any way affect the following parameters will be considered as a change in the substance of a bid: a) Evaluation & qualification criteria; b) Required scope of work or specifications; c) All securities requirements; d) Tax requirements; e) Terms and conditions of bidding documents. f) Change in the ranking of the Bidder iv) From the time of Bid opening to the time of Contract award if any Bidder wishes to contact the Procuring Agency on any matter related to the Bid it should do so in writing or in electronic forms that provide record of the content of communication.

2.5.4. Preliminary Examination	i) The Procuring Agency will examine the Bids to determine whether they are complete, whether any computational errors have been made, whether required sureties have been furnished, whether the documents have been properly signed, and whether the Bids are generally in order. ii) Arithmetical errors will be rectified on the following basis:- a. If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail, and the total price shall be corrected. If the Supplier does not accept the correction of the errors, its Bid may be rejected, and its Bid security may be forfeited. b. If there is a discrepancy between words and figures, the amount in words will prevail. iii) Prior to the detailed evaluation, the Procuring Agency will determine the responsiveness of each Bid to the Bidding documents, pursuant to ITB Clause 2.5.5. For purposes of these Clauses, a responsive Bid is one which conforms to all the terms and conditions of the Bidding documents without material deviations. Deviations from, or objections or reservations to critical provisions, **such as** those concerning **Bid Security** (ITB Clause 2.3.8), **Applicable Law** (GCC Clause 30), **Taxes and Duties** (GCC Clause 32) & mandatory Registrations/ Renewals will be deemed to be a material deviation. The Procuring Agency's determination of a Bid's responsiveness is to be based on the contents of the Bid itself without recourse to extrinsic evidence. iv) If a Bid is not responsive, it will be rejected by the Procuring Agency and may not subsequently be made responsive by the Bidder by correction of the non-conformity. v) Prior to the detailed evaluation of Bids, the Procuring Agency will determine whether each Bid: a) Meets the eligibility criteria defined in **ITB 2.1.3** and **ITB 2.1.4**; b) Has been prepared as per the format and contents defined by the Procuring Agency in the Bidding Documents; c) Has been properly signed; d) Is accompanied by the required securities; and e) Is responsive to the requirements of the Bidding Documents. The Procuring Agency's determination of a Bid's responsiveness will be based on the contents of the Bid itself.

2.5.5. Examination of Terms and Conditions; Technical Evaluation	i) The Procuring Agency shall examine the Bid to confirm that all terms and conditions specified in the **GCC** and the **SCC** have been accepted by the Bidder without any material deviation or reservation. ii) The Procuring Agency shall evaluate the technical aspects of the Bid submitted to confirm that all requirements specified in **Section III- Technical Specifications, Section VII – Schedule of Requirements & Evaluation Criteria as provided in BDS,** have been met without material deviation or reservation. iii) If after the examination of the terms and conditions and the technical evaluation, the Procuring Agency determines that the Bid is not responsive in accordance**,** it shall reject the Bid.
2.5.6. Correction of Errors	i) Bids determined to be substantially responsive will be checked for any arithmetic errors. Errors will be corrected as follows: - a) If there is a discrepancy between unit prices and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail, and the total price shall be corrected, unless in the opinion of the Procuring Agency there is an obvious misplacement of the decimal point in the unit price, in which the total price as quoted shall govern and the unit price shall be corrected; b) If there is an error in a total corresponding to the addition or subtraction of sub-totals, the sub-totals shall prevail and the total shall be corrected; and c) Where there is a discrepancy between the amounts in figures and in words, the amount in words will govern. d) Where there is discrepancy between grand total of price schedule and amount mentioned on the Form of Bid, the amount referred in Price Schedule shall be treated as correct subject to elimination of other errors. ii) The amount stated in the Bid will, be adjusted by the Procuring Agency in accordance with the above procedure for the correction of errors. The concurrence of the Bidder shall be considered as binding upon the Bidder. If the Bidder does not accept the corrected amount, its Bid will then be rejected, and the Bid Security may be forfeited or the Bid Securing Declaration may be executed in accordance with **ITB 2.3.8.**
2.5.7. Conversion to Single Currency	i) As per rule 32(2) of PPR-14, to facilitate evaluation and comparison, the Procuring Agency will convert all Bid prices expressed in the amounts in various currencies in which the Bid prices as follows:

	For the purposes of comparison of bids quoted in different currencies, the price shall be converted into a single currency specified in the bidding documents. The rate of exchange shall be the selling rate, prevailing on the date of opening of bids specified in the bidding documents, as notified by the State Bank of Pakistan on that day, in case of holiday in State Bank of Pakistan on the day of opening financial bids, then previous working day's ex-change rates will prevail.
2.5.8. Post-Qualification & Evaluation of Bids	i) In the absence of **prequalification**, the Procuring Agency will determine to its satisfaction whether the Bidder is qualified to perform the contract satisfactorily, in accordance with the evaluation criteria listed in BDS & pursuant to ITB Clause 2.1.3. ii) The determination will take into account the Bidder's financial, technical, and production/ supplying capabilities. It will be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB Clause 2.3.6, as well as such other information required for eligibility/qualification expressed in Bid Data Sheet as the Procuring Agency deems necessary and appropriate. iii) The Procuring Agency will **technically evaluate** and compare the Bids which have been determined to be responsive, pursuant to ITB Clause 2.5.5, as per Technical Specifications required. iv) The **financial evaluation** of a Bid will be on the basis of form of Price Schedules/ Financial Bid Form 8.10 to be decided by the Procuring Agency which must include clear cut instruction regarding item wise or package wise evaluation inclusive of prevailing taxes, duties, fees etc.
2.5.9. Contacting the Procuring Agency	i) Subject to ITB Clause 2.5.3, no Bidder shall contact the Procuring Agency on any matter relating to its Bid, from the time of the Bid opening to the time the evaluation report is made public i.e. 10 days before the contract is awarded. If the Bidder wishes to bring additional information or has grievance to the notice of the Procuring Agency, it should do so in writing. ii) Any effort by a Bidder to influence the Procuring Agency during Bid evaluation, or Bid comparison may result in the rejection of the Bidder's Bid.

2.5.10. Grievance Redressal	i) As per Rule-67 of PPR-14, Procuring Agency shall constitute a Grievance Redressed Committee (GRC) comprising of odd number of persons with proper powers and authorization to address the complaints. The GRC shall not have any of the members of the Procurement Evaluation Committee. The Committee may preferably have one subject specialist depending upon the nature of the procurement in addition to one person with legal background as per their availability to the Procuring Agency. ii) Any Bidder feeling aggrieved can file its written complaint against the eligibility parameters or any other terms and conditions prescribed in the Bidding documents found contrary to provision of Rule 33, and the same shall be addressed by the Procuring Agency well before the proposal submission deadline. iii) Any party can file its written complaint against the eligibility parameters or any other terms and conditions prescribed in the bidding documents found contrary to provision of Rule 34 and the same shall be addressed by the Procuring Agency well before the proposal submission deadline. iv) Any Bidder feeling aggrieved by any act of the Procuring Agency after the submission of his Bid may lodge a written complaint concerning his grievances not later than ten days after the announcement of the Final evaluation reports. In case of single stage - two envelope bidding procedure any bidder feeling aggrieved from technical evaluation may file a grievance within 5 days of announcement of the technical evaluation report. After completion of the technical evaluation process, the procuring agency shall immediately upload the technical evaluation report on the website of PPRA and Procuring Agency for obtaining/ receiving grievance petitions from the prospective bidders (if any). v) In case, the complaint/grievance is filed after the issuance of the final evaluation report, the complainant cannot raise any objection on technical evaluation of the report. Provided that the complainant may raise the objection on any part of the final evaluation report in case where single stage one envelop bidding procedure is adopted. vi) The GRC shall investigate and decide upon the complaint within fifteen days of the receipt of the complaint. Mere fact of lodging of a complaint shall not warrant suspension of the procurement process.

2.6. Award of Contract	
2.6.1. Notification of Award	i) Prior to the expiration of the period of Bid validity, the Procuring Agency will notify the successful Bidder in writing by registered letter and by email to be confirmed in writing by registered letter, that its Bid has been accepted. ii) The notification of award will constitute the formation of the Contract. iii) Upon the successful Bidder's furnishing of the Performance Guarantee pursuant to ITB Clause 2.6.2 (i), the Procuring Agency will promptly notify each unsuccessful Bidder and will discharge its Bid security, pursuant to ITB Clause 2.3.8 (v).
2.6.2. Performance Guarantee	i) Within fifteen (15) *[to be decided by the procuring agency]*days of the receipt of notification of award from the Procuring Agency, the successful Bidder shall furnish the Performance Guarantee in accordance with the Conditions of Contract, in the Performance Guarantee Form provided in the Bidding documents, or in another form acceptable to the Procuring Agency. ii) Failure of the successful Bidder to comply with the requirement of ITB Clause (i) above or ITB Clause 2.6.3 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid security along with other remedies available under PPR-14. After that, the Procuring Agency may decide to award the contract to the next lowest evaluated Bidder, keeping in view the Bid validity time, or call for new Bids keeping in view the concept of value for money as defined under rule-2(ae) read with Principles of Procurement as enunciated in rule-4 of PPR-14.
2.6.3. Signing of Contract/ Issuance of Purchase Order	i) At the same time as the Procuring Agency notifies the successful Bidder that its Bid has been accepted, the Procuring Agency will send the Bidder the Contract Form provided in the Bidding documents, incorporating all agreements between the parties or will issue the purchase order *[as the case may be]*. ii) Under rule-63 of PPR-14, where the Procuring Agency requires formal signing of contract, within seven (07) days of receipt of the Contract Form, the successful Bidder shall sign and mention the date of the contract and return it to the Procuring Agency.

	iii) Where no such formal signing is required by the procuring agency, the procuring agency shall issue purchase order after the receipt of required performance guarantee, as per rule 55 of PPR-14.
2.6.4. Award Criteria	i) Subject to ITB Clause 2.6.2, under rule-55 of PPR-14, the Procuring Agency will award the contract to the successful Bidder whose Bid has been determined to be responsive and has been determined to be the lowest evaluated Bid, provided that the Bidder has been determined to be qualified to perform the contract satisfactorily.
2.6.5. Procuring Agency's Right to Vary Quantities at Time of Award	i) The Procuring Agency reserves the right at the time of contract award to increase or decrease the quantity of goods and services originally specified in the Schedule of Requirements without any change in unit price or other terms and conditions, on the analogy of rule-59 (c)(iv) of PPR-14 (not more than 15%).
2.6.6. Procuring Agency's Right to Accept or Reject All Bids	i) As per rule 35 of PPR-14, the Procuring Agency reserves the right to accept or reject all Bids or proposals (and to annul the Bidding process) at any time prior to the acceptance of any Bid or proposal, without thereby incurring any liability towards the Bidders. ii) The Bidders shall be promptly informed about the rejection of the Bids, if any iii) The Procuring Agency shall upon request communicate to any Bidder, the grounds for its rejection of all Bids or proposals, but shall not be required to justify those grounds.
2.6.7. Re-Bidding	i) If the Procuring Agency rejects all the Bids under rule 35, it may proceed with the process of fresh Bidding but before doing that it shall assess the reasons for rejection and may, if necessary, revise specifications, evaluation criteria or any other condition for Bidders.

2.6.8. Corrupt or Fraudulent Practices	i) The Procuring Agency Bidders, Suppliers, and Contractors observe the highest standard of ethics during the procurement and execution of contracts. "Corrupt practices" in respect of procurement process, shall be as given in S-2 (d) of PPRA, Act, 2009, which is as follows: *"(d) "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value to influence the action of a public official, bidder or Contractor in the procurement process or in Contract execution to the detriment of the procuring agency; or misrepresentation of facts in order to influence a procurement process or the execution of a Contract, collusive practices among bidders (prior to or after bid submission) designed to establish bid prices at artificial, noncompetitive levels and to deprive the procuring agency of the benefits of free and open competition and any request for, or solicitation of anything of value by any public official in the course of the exercise of his duty; it may include any of the following:* *i. Coercive practice by impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence the actions of a party to achieve a wrongful gain or to cause a wrongful loss to another party;* *ii. Collusive practice by arrangement between two or more parties to the procurement process or Contract execution, designed to achieve with or without the knowledge of the procuring agency to establish prices at artificial, noncompetitive levels for any wrongful gain;* *iii. Offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the acts of another party for wrongful gain;* *iv. Any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;* *v. Obstructive practice by harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in a procurement process, or affect the execution of a Contract or deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements before investigators in order to materially impede an investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or acts intended to materially impede the exercise of inspection and audit process."*

ii) Blacklisting & Debarment:

Blacklisted Bidders i.e. firms/companies/sole proprietor/ general order suppliers/ JVs etc. and those found involved in "Corrupt Practices" are not allowed to participate in bidding.

Requirements & Procedure for Blacklisting & Debarment:

As per S-17A of PPRA, Act, 2009:

***"17A. Blacklisting**.– (1) A procuring agency may, for a specified period and in the prescribed manner, debar a bidder or Contractor from participating in any public procurement process of the procuring agency, if the bidder or Contractor indulges in corrupt practice or any other prescribed practice.*

(2) *The Managing Director may, in the prescribed manner, debar a bidder or Contractor from participating in any public procurement process of all or some of the procuring agencies for a specified period.*

(3) *Any person, aggrieved from a decision of a procuring agency, may within prescribed period prefer a representation before the Managing Director.*

(4) *A procuring agency or any other person, aggrieved from a decision of the Managing Director, may within prescribed period prefer a representation before the Chairperson whose decision on such representation shall be final.]*

As per rule 21 of PPR-14:

***21. Blacklisting**.–(1) A procuring agency may, for a specified period, debar a bidder or Contractor from participating in any public procurement process of the procuring agency, if the bidder or Contractor has:*

(a) acted in a manner detrimental to the public interest or good practices;

(b) consistently failed to perform his obligation under the Contract;

(c) not performed the Contract up to the mark; or

(d) indulged in any corrupt practice.

(2) If a procuring agency debars a bidder or Contractor under sub-rule (1), the procuring agency:

(a) shall forward the decision to the Authority for publication on the website of the Authority; and

Bidder's Signature & Stamp

	(b) may request the Authority to debar the bidder or Contractor for procurement of all procuring agencies. *(3) The Managing Director may debar a bidder or Contractor of any procuring agency from participating in any public procurement process of all or some of the procuring agencies for such period as the Managing Director may determine.* *(4) Any person aggrieved by a declaration made under rule 20 or a decision under sub-rule (1) of this rule may, within thirty days from the date of the publication of the information on the website of the Authority, file a representation before the Managing Director and the Managing Director may pass such order on the representation as he may deem fit.* *(5) Any person or procuring agency aggrieved by an order under sub-rule (3) or (4) may, within thirty days of the order, file a representation before the Chairperson and the Chairperson may pass such order on the representation as he may deem appropriate.* *(6) The mechanism or process for barring a bidder or Contractor from participating in procurement process of a procuring agency, procuring agencies and a representation under this rule is specified in the Schedule appended to these rules.* *As per Schedule appended with PPR-14:* ***SCHEDULE*** *see sub-rule (6) of rule 21* ***BLACKLISTING MECHANISM OR PROCESS*** *1. The procuring agency may, on information received from any resource, issue show cause notice to a bidder or Contractor.* *2. The show cause notice shall contain:* *(a) precise allegation, against the bidder or Contractor;* *(b) the maximum period for which the procuring agency proposes to debar the bidder or Contractor from participating in any public procurement of the procuring agency; and* *(c) the statement, if needed, about the intention of the procuring agency to make a request to the Authority for debarring the bidder or Contractor from participating in public procurements of all the procuring agencies.* *3. The procuring agency shall give minimum of seven days to the bidder or Contractor for submission of written reply of the show cause notice.* *4. In case, the bidder or Contractor fails to submit written reply within the requisite time, the procuring agency may issue notice for personal hearing to the bidder or Contractor/ authorize representative of the bidder or Contractor and the procuring agency*

	shall decide the matter on the basis of available record and personal hearing, if availed. *5. In case the bidder or Contractor submits written reply of the show cause notice, the procuring agency may decide to file the matter or direct issuance of a notice to the bidder or Contractor for personal hearing.* *6. The procuring agency shall give minimum of seven days to the bidder or Contractor for appearance before the specified officer of the procuring agency for personal hearing.* *7. The procuring agency shall decide the matter on the basis of the available record and personal hearing of the bidder or Contractor, if availed.* *8. The procuring agency shall decide the matter within fifteen days from the date of personal hearing unless the personal hearing is adjourned to a next date and in such an eventuality, the period of personal hearing shall be reckoned from the last date of personal hearing.* *9. The procuring agency shall communicate to the bidder or Contractor the order of debarring the bidder or Contractor from participating in any public procurement with a statement that the bidder or Contractor may, within thirty days, prefer a representation against the order before the Managing Director of the Authority.* *10. The procuring agency shall, as soon as possible, communicate the order of blacklisting to the Authority with the request to upload the information on its website.* *11. If the procuring agency wants the Authority to debar the bidder or Contractor from participating in any public procurement of all procuring agencies, the procuring agency shall specify reasons for such dispensation.* *12. The Authority shall immediately publish the information and decision of blacklisting on its website.* *13. In case of request of a procuring agency under para 11 or representation of any aggrieved person under rule 21, the Managing Director shall issue a notice for personal hearing to the parties and call for record of proceedings of blacklisting. The parties may file written statements and documents in support of their contentions.* *14. In case of representation of any aggrieved person or procuring agency under rule 21, the Chairperson shall issue a notice for personal hearing to the parties and may call for the record of the proceedings. The parties may file written statements and documents in support of their contentions.*

	15. In every order of blacklisting under rule 21, the procuring agency shall record reasons of blacklisting and also reasons for short, long or medium period of blacklisting. *16. The Authority shall upload all the decisions under rule 21, available with it, on its website. But the name of a bidder or Contractor shall immediately be removed from the list of blacklisted persons on expiry of period of blacklisting or order of the competent authority to that effect, whichever is earlier.* *17. An effort shall be made for electronic communication of all the notices and other documents pursuant to this mechanism or process."* iii) Furthermore, Bidders must keep themselves aware of the provision stated in clause 5.4 and clause 24.1 of the General Conditions of Contract.
2.6.9. Quantity and volume of the goods to be considered in mind *[Framework Contract Modality]*	i) While quoting the rate in a framework contract, the Bidder must consider the following facts: a. Certain volume and quantity of the goods as prescribed in Bid Data Sheet. b. The Bidder have to maintain the rates of the goods for the whole financial year. c. The Bidder should quote the rate as per Price Schedule/ Financial Bid form. In case of non-observance of prescribed format, Financial Bid may be rejected.

Section-III: Technical Specifications

Note: Detailed Specification and drawings for the reference has been annexed at the end of this bidding document.

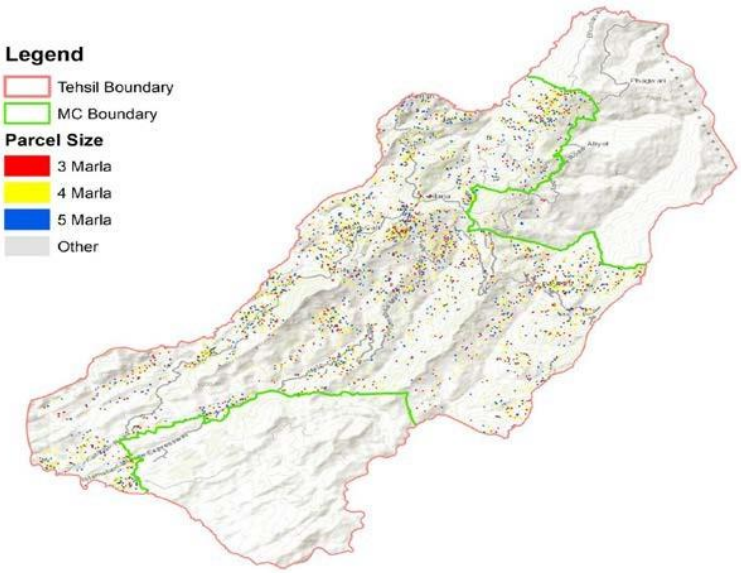
PROJECT OVERVIEW

Rainwater Harvesting is an initiative designed to address critical environmental and resource challenges. Rainwater harvesting is essential in Murree due to the region's vulnerability to water scarcity, particularly during dry periods. Climate change is an additional threat that puts increased pressure on already stressed hydrological systems and water resources. Rainwater harvesting is listed among the specific adaptation measures to cope with future climate change. At present, there is limited application of RWH in the region, despite its high potential for alleviating the impacts of climate change on water security in Murree and many other cities.

The proposed project aims to address water scarcity by including rooftops of 3, 4, and 5 Marla properties. Broad coverage shall ensure the efficient utilization of available surfaces, enhancing the project's viability as a solution to augment conventional water sources and promote sustainable water management practices.

Central to the project's goals is the reduction of dependency on conventional water sources. By installing storage tanks, the project ensures that harvested rainwater is readily available for use during dry periods of HHs. This approach not only alleviates the strain on municipal water supplies and groundwater but also fosters resilience in water supply systems, thereby integrating rainwater into the existing water supply infrastructure for a more sustainable and efficient water management system.

The map below indicates the identified properties of sizes 3 Marla, 4 Marla and 5 Marla in the Murree Tehsil.



SUMMARY OF PROJECT

This tender document specifically pertains to Phase-I of the project in which Rainwater Harvesting Units are to be installed for approximately 35 houses/residential units of low-income 3, 4, and 5 Marla houses in Murree MC area including Government Buildings & Girls Schools as identified by the client and distributed across MC area. Defect liability period for the project would be 1 year from completion/operationalization of the rainwater harvesting systems. Total time for completion of the project is 45 Days from the award of contract. The contractor is expected to start the mobilization & site execution of the awarded work in August 2024. The details of the Project requirement are described as follows.

Sr.	Project Scope & Description / Numbers
1.	Rainwater Harvesting Systems for 3 Marla Houses – 11 Nos
2.	Rainwater Harvesting Systems for 4 Marla Houses – 12 Nos
3.	Rainwater Harvesting Systems for 5 Marla Houses – 7 Nos
4.	Rainwater Harvesting Systems for Govt Buildings – 5 Nos
	Total Cost of Project PKR 15 million

MAIN TASKS FOR THE INSTALLATION OF RWH SYSTEMS

The Project aims to construct Rainwater Harvesting (RWH) systems across various locations to optimize rainwater collection and utilization. This initiative will contribute to sustainable water management and alleviate water scarcity issues in the targeted areas. Details of main tasks to be performed by the contractor includes but are not limited to the following:

1. **Site Survey and Preparation:** Conduct comprehensive site surveys for each of the identified locations for 3, 4, and 5 Marla. Assess the roof size, slope, and structural integrity to ensure optimal rainwater collection. Clear and prepare each site for construction, removing any obstructions that could hinder the installation process.

2. **Procurement of Materials:** Send submittal for procurement approval with samples (each type for 3, 4, 5 Marla) to the engineer. Source and purchase all required materials, including storage tanks, gutters, downspouts, filtration systems, and plumbing supplies. Ensure that all materials meet quality standards and are suitable for the specific requirements of the RWH systems.

3. **Installation of Gutters and Downspouts:** Install or upgrade gutters and downspouts on each roof to effectively channel rainwater into the storage tanks. This step is crucial for maximizing the efficiency of rainwater collection.

4. **Storage Tanks:** Construct or install storage tanks at each site, ensuring proper placement and secure installation. The tanks will be designed to handle the expected volume of

rainwater and should be durable enough to withstand environmental conditions. Each tank should be imprinted with the project logo and the project name as specified by the client. Moreover, the color of the tank is subject to approval of the client (White for 5 Marla, Blue for 4 Marla and Green for 3 Marla Units). The contractor is also required to install the information plate with QR code at each house (*refer to the Technical Specifications for details*).

5. **Installation of Filtration and Treatment Systems:** Set up first flush diverters, filters, and any additional treatment systems to ensure the quality of harvested rainwater. This ensures that the water collected is suitable for its intended uses.

6. **Plumbing and Installation:** Install the necessary plumbing to connect storage tanks to distribution points. Set up necessary allied features, if needed, to facilitate the distribution of water to different parts of the property. This ensures efficient water usage and accessibility.

7. **Overflow and Drainage Systems:** Implement overflow systems to manage excess rainwater during heavy rains. Ensure proper drainage to prevent flooding or waterlogging, protecting both the property and the RWH system.

8. **System Testing and Commissioning:** Test each RWH system to ensure that all components are functioning correctly. Conduct any necessary adjustments or repairs to optimize performance. Commission the systems once they are fully operational.

9. **Training and Handover:** Provide training to property owners or maintenance personnel on how to operate and maintain the RWH systems. Hand over comprehensive documentation and user manuals for each system to ensure proper usage and upkeep.

10. **Water Quality & Level Indicators/Sensors:** Provide and add the Water Quality Indicator System (to measure PH, TDS, EC), Water Level Indicator and Water Meter in tanks. Install MIS /IT system to relay the information to a centralized system and tracking of the tank if stolen to be approved by the Engineer.
11. Tank requirements: project logo, “MC Murree,” full project name, “Not for Sale” label, and confirmation of Food Grade quality.

12. Stickers for pasting on tanks and in homes.

13. Home steel sheet displaying project details.

14. Water level indicators to included on each tank.

15. A book of 100 copies for household monitoring of Ph,EC, and tank filling to be printed.

16. Stickers printing of project

17. Tanks to be painted in the designated project color.

18. Project duration: 45 Days.

19. Installation of 3 tanks in August.

20. Each tank must have a unique number and a scannable code.

21. **As-Built Drawings:** Submit as-built drawing(s) and proof of asset installed with specified logo clearly displayed.
22. **Progress Reporting Mechanism:** The contractor will report the progress of the project execution on a two weekly basis.

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TERMS OF PAYMENT

Following Payment, the terms shall be followed:
Note : 10 % Performance Guarantee for Contract Value shall be submitted within 7 working days after signing of Agreement which shall be retained till completion of Work.

The Contracts request(s) for payment shall be made to the Urban Unit in writing, accompanied by an invoice no less than 5 million in amount, and delivery challans/Inspection Reports/check requests describing, as appropriate, the Equipment delivered upon the fulfillment of other obligations stipulated in the Contract.
The currency of payment will be Pakistan Rupees.
All Taxes shall be Deducted as per the Laws of Government of Pakistan.

TECHNICAL SPECIFICATIONS OF GOODS, MATERIALS AND TESTING

1. Materials and Goods

1.1. Cement

1) Cement for concrete and mortar shall be the best Portland cement of quality conforming to the current British Standard Specifications for the type of cement specified to be used, and shall be obtained from a firm approved by the Client. Cement shall be stored in the damp-proof shed and shall be used in the order of its delivery. Any cement that has deteriorated or has become contaminated shall not be used and shall be removed immediately from the site by the Contractor at his own expense. The cement used for all fair-faced concrete or floors shall be that necessary to obtain a light shade

concrete as approved by the Client. Unless designated otherwise the cement to be used under this contract shall be Ordinary (grey) Portland cement conforming to BS-12.

1.2. Water

1) Only clean fresh water free from impurities and deleterious matter and without excessive salt content shall be used. Where the water is not obtained from the public supply the Contractor shall submit at his own expense any analysis, from an approved analyst, of the water he intends to use in construction, for approval of the Client.

1.3. Sand (Fine Aggregate)

1) The sand shall be clean and gritty from Chenab and composed of hard siliceous grains and other materials as approved by the Client. It shall be free from clay, dust, salt, silt or any organic, alkali or bituminous matter. The materials shall be well graded and shall all pass-through BS Test Sieve measuring 3/16" square, and for reinforced concrete, the maximum quantities of clay, silt and fine dust shall not be more than 3% by weight when using the test in BS-812 (1967), Clause-13. Sands with more than 5% fines or clay shall be washed.

1.4. Coarse Aggregates

1) Coarse aggregates shall be obtained from approved quarries and shall consist of clean, hard, strong, durable, non-absorbent, crushed stone free from clay, dust, salt, silt or any organic alkali or bituminous matter. Coarse aggregate shall comply with the requirements of BS-882.

2) The coarse aggregate shall be well graded from the maximum size specified and shall all be retained on a sieve with mesh measuring 3/16" square. For use in reinforced concrete, the maximum size of coarse aggregate shall be as per Table given in Clause 2.8.

3) Soon after the award of work, the Contractor shall submit a sample enough for carrying out required tests, to the Client, for approval. For every consignment of aggregate from the approved source, sieve analysis shall not show a variation of ±5% from the approved sample of aggregate for each sieve. Graded aggregate shall be stored separately on-site on a concrete slab 3" thick and properly subdivided to prevent mixing and contamination of fine and coarse aggregates. Aggregates that in the opinion of the Client are not clean or have become mixed due to defective storage shall be removed from the site immediately.

1.5. Admixtures

1) The use of admixtures to promote workability or improvement in strength shall be only on the written instructions and approval of the Client. "Pudlo" or equivalent water-proofing admixture shall be used in concrete for Water Tanks and Reservoirs according to printed instructions of the manufacturers and as approved by the Consultant. Unless indicated in BOQ, the rate of concrete work shall not include the cost of providing and mixing water-proofing chemicals, surface hardeners, and other additives.

1.6. Paint

1) The paint must comply with PSQCA standards and be sourced from reputable manufacturers like Master Paints, Dulux Paints, Berger Paints, Nippon Paints, or equivalent. It should be weather-proof for exterior use and/or enamel as specified, capable of withstanding UV radiation, rain, and temperature variations. The application requires two coats: the first as a primer for adhesion and uniform base, the second for final finish and color consistency.

2) The paint should offer full coverage of the roof, adhesion to surface of the roof sheet and elevation, and should offer resistance to peeling, cracking, and fading. The paint color as proposed is Red for roof and White for front elevation but may be subject to change after approval from client if required.

1.7. Water Storage Tank

1) The water tanks must comply with Pakistan Standards and Quality Control Authority (PSQCA) specifications for plastic storage tanks (PS: 4991-2004) and be made from virgin, food-grade polyethylene, UV-stabilized to prevent degradation. The tanks, with capacities ranging from 1000 liters to 4000 liters, must be rotomolded in a single piece with uniform wall thickness and free from defects.

2) They should have a cylindrical, vertical design with a domed top and flat bottom, a tightly fitting lockable lid, at least one inlet and one outlet with threaded connections, a vent or overflow outlet, and provision for a level indicator. The tanks must also have a designated area for affixing a custom monogram or logo sticker as specified by the client.

3) Each tank must withstand hydrostatic pressure without deformation and be leak-proof, certified for storing potable water, and come with documentation proving compliance with food-grade standards. Each tank must have a RFID chip embedded/embossed and should clearly display a QR code, which when scanned, provides information about the project and safe water use practices for potable and non-potable rainwater usage applications and other education material.

4) Reputable manufacturers like Dura or Popular should supply the tanks, which must have a minimum 5-year warranty against manufacturing defects. Clear installation and maintenance instructions, along with labels indicating the manufacturer's name, capacity, material grade, and date of manufacture, must be included. Suppliers must provide compliance certificates, technical datasheets, and warranty documents with the delivery. Reference image of the tank with logo is attached in the section below.

5) The color of the food grade water storage tanks should be as follows.

Sr.	Property Size / Type	Tank Color
1	3 Marla (Residential Unit)	Blue
2	4 Marla (Residential Unit)	Green
3	5 Marla (Residential Unit)	White
4	Government Buildings	White

1.8. Water Filter

1) The water filtration system must comply with Pakistan Standards and Quality Control Authority (PSQCA) specifications and applicable ISO standards, specifically ISO 9001:2015 for quality management and ISO 14001:2015 for environmental management. The system should be a three-stage ultrafiltration (UF) type designed for kitchen use with removable and replaceable filters. The first stage must include a 5-micron sediment filter to remove large particles and sediments, the second stage must have a granular activated carbon (GAC) filter to remove chlorine, odors, and organic compounds, and the third stage should use a UF membrane with a pore size of 0.01 microns to remove bacteria and viruses, ensuring the water is potable. The filtration system must be made from food-grade, BPA-free materials compliant with FDA standards. It should be designed for easy installation and maintenance, with each filter stage easily accessible for replacement.

2) The system should feature a compact design suitable for under-sink installation, with inlet and outlet connections compatible with standard plumbing fittings. It must be capable of handling a minimum flow rate of 1.5 liters per minute and operate effectively at water pressures between 1.5 and 4.0 bar. The system should include a user-friendly indicator for filter replacement and come with clear instructions for installation, use, and maintenance. Reputable manufacturers with proven track records should supply the filtration systems. Suppliers must provide compliance certificates, technical datasheets, and warranty documents, ensuring the system meets all required safety and performance

criteria. The system must come with a minimum 2-year warranty against manufacturing defects.

2. Plumbing and Allied Fixtures

2.1. Water Meter

1) Water meters shall be supplied by approved manufacturers such as KSB, or other equivalent and approved manufacturers, and must comply with relevant international and local standards (e.g., ISO 4064, AWWA C700, etc.).

2) The water meter body shall be made of high-quality materials such as brass, bronze, or stainless steel, suitable for potable water applications. The components including impellers, seals and glass should be durable, made of corrosion free material and of high quality and grade.

3) Water meters shall be available in different sizes as per the size of pipe adopted for the rainwater harvesting system, including but not limited to 1/2 inch, 3/4 inch, 1 inch, or as per the project requirements.

4) Water meters must have an accuracy class of at least Class 1 or Class 2. The starting flow rate, minimum flow rate, and maximum flow rate should conform to the standards specified for the size of the meter. Functional tests, pressure tests, and accuracy tests must be conducted to ensure proper operation. A minimum warranty period of one year from the date of commissioning should be provided.

2.2. Piping and Fitting

1) PVC pipes shall be the best quality manufactured by Pakistan PVC Ltd or Popular or other approved equivalent conforming to BS-3506-1969. The fittings such as flanges, sockets, tees and bends shall conform to BS-4346-1969. Sluice valves for PVC pipes shall conform to relevant British Specifications and the jointing will be done as for PVC pipes. The rainwater collection works would consist of non-pressurized drainpipes, of UPVC medium class B. The pipes and fittings for water supply shall be capable of withstanding a pressure of 400' head of water. The joining shall be done by PVC solvent cement 70.

2.3. Water Quality Sensors

1) The water quality sensors for installation on water tanks must measure Electrical Conductivity (EC), pH, and Total Dissolved Solids (TDS) with precision. The EC sensor should cover a range of 0 – 200,000 µS/cm, with ±1% accuracy across three auto-range scales. The TDS sensor should measure from 0 – 100,000 mg/L (ppm), with ±1% accuracy over two auto-range scales. The pH sensor should operate within a range of 0 – 14 pH units, with ±0.1 pH accuracy. These sensors are crucial for continuous monitoring to ensure water quality meets safety standards, with clear documentation for installation and calibration procedures provided.

2.4. Float Switches

1) The float valve is constructed from stainless steel materials such as SS201, SS304, or SS316, ensuring durability and corrosion resistance suitable for various applications. It features a 2-way configuration with the float lever positioned downwards for optimal operation. The valve is designed to handle media including potable water, diesel, and kerosene, making it versatile for different fluid types. It accommodates connection sizes ranging from 1/2" to 4" and includes a float with a diameter of 200 mm to regulate fluid levels effectively. The valve is rated for a maximum design temperature of 60°C and can withstand pressures up to 8 Kg/cm². Its horizontal mounting position allows for efficient installation and operation in diverse industrial and commercial settings, ensuring reliable performance and long-term durability.

2.5. Rain Gutters and Appurtenances

1) The rain gutters, fabricated from at least a 20-gauge galvanized iron (G.I.) sheet as per drawing, must be designed to efficiently channel rainwater along roof edges. They should feature a seamless construction to prevent leaks and ensure durability against weathering. The gutters must be available in standard sizes suitable for various roof configurations (3, 4, 5 Marla), with adequate slope for optimal drainage.

2) Additionally, the gutter guard and leaf filter system should complement the gutters, preventing debris such as leaves and twigs from clogging the system. The guard and filter must be made from durable materials resistant to rust and corrosion, ensuring longevity and minimal maintenance. They should allow for easy installation and cleaning, preserving the efficiency of the gutter system throughout its lifespan. These components are essential for maintaining clear and effective water flow and protecting buildings from potential water damage caused by overflowing gutters.

3. Testing, Commissioning and Finishing

1) After the installation phase is completed, the contractor is obligated to conduct comprehensive field tests on all equipment, materials, and systems under the supervision of the client or their authorized representative. The Contractor is responsible for procuring and utilizing all necessary tools, instruments, test equipment, materials, and personnel essential for the thorough execution of the testing procedures. All test results must be meticulously recorded and presented to the Client, endorsed by the Contractor's testing engineer.

2) Additionally, the Contractor must seek prior approval from the Client before initiating any testing activities. Testing may also be conducted at accredited testing laboratories such as PCSIR, UET Lahore, or other competent public sector facilities that conform to both local and international material testing standards. These provisions ensure that all installed components meet specified performance criteria and regulatory requirements

3) Finishing works constitute an integral component of the project and shall be executed in accordance with site-specific requirements. Such works may include, but are not limited to, the painting of facades, walls, and/or roofs of the structures. All finishing works are subject to the approval of the Procuring Agency

4) The contractor is liable for the upgradation and/or repair of damages occurred to the public and private properties/assets during the installation of the rainwater harvesting system. The upgradation will include but not limited to paint works, civil works, wood works and/or as deemed appropriate by the representative of the procuring agency.

5) The Contractor will ensure to display the project logo/monogram with paint or as recommended by the Procuring Agency on the water collection tanks and/or where identified by the Procuring Agency. The design must include a QR code, which when scanned, provides information about the project and safe water use practices for potable and non-potable rainwater usage applications and other education material. The design of the project logo/monogram and information displayed on QR code is subject to approval of the Procuring Agency.

6) The Contractor shall install a Project Information Plate of stainless steel or equivalent material, with dimensions of at least 12" x 18", featuring the project title and logo and other related information engraved and/or imprinted as specified by the procuring agency. The contractor shall seek approval from the procuring agency for the design, dimensions, pasting mechanism and material of the information plate prior to its manufacturing and installation. Reference Image is attached in the section below.

SAMPLE PHOTOS OF MATERIALS, GOODS & FITTINGS

Figure 1: Sample Information Plate as displayed on RWH System at Kashmir Point

Figure 2: Sample picture of a 3-Stage Water Filter for kitchen use

Figure 3: Sample picture of drainpipes and fittings of brand Popular Pipes

Figure 5: Sample picture of a GI rain gutter to be installed on roofs

Figure 4: Sample picture of a Food Grade Tank of brand TurkPlast with painted logo clearly visible

Section-IV: Bid Data Sheet

The following specific data for the goods to be procured shall complement, supplement, or amend the provisions in the Instructions to Bidders (ITB) Section II. Whenever there is a conflict, the provisions herein shall prevail over those in ITB.

[Instructions for completing the Bid Data Sheet are provided, as needed, in the notes in italics mentioned for the relevant ITB Clauses which may be deleted while submitting the Bids.]

A. Introduction		
BDS Clause Number	**ITB Number**	**Amendments of, and Supplements to, Clauses in the Instruction to Bidders**
1.	**2.1.1**	Name of Procuring Agency: Urban Sector Planning & Management Services Unit (Private) Limited. The subject of procurement is: *Supply, Installation, Testing, and Commissioning of 35 Rooftop Rainwater Harvesting System in Murree MC* Period for delivery of goods: The winning bidder shall start immediately after the award of the contract/issuance of the Purchase Order and shall complete the delivery of goods within 7 days after the signing of the contract/issuance of the Purchase Order. Commencement date for delivery of Goods: Immediately after award of contract
2.	**2.1.2**	Financial year for the operations of the Procuring Agency: *2024-2025* Name of Project/ Grant (Development or Non-Development): *ADP Chief Minister Initiative – Murree Development Programme – Rooftop Rainwater Harvesting in MC Murree* Name of financing institution: *Government of the Punjab*
3.	**2.1.3 (iv)**	Maximum number of members in the joint venture, consortium or association shall be: *Two (2)* J.V. form 8.2 should be followed.
4.		Ineligible country(s) is *Israel*

5.	**2.3.6(iii)**	Demonstration of authorization by manufacturer: NOT REQUIRED
B. Bidding Documents		
6.	**2.2.2**	The address for clarification of Bidding Documents is *Office of the Senior Procurement Manager, The Urban Unit, 503 – Shaheen Complex, Egerton Road, Lahore*
7.	**2.2.2**	Pre-bid meeting will be not be held.
8.	**2.3.9**	The number of bidding documents to be completed and returned is in one original and four copies of original.
C. Bid Price, Currency, Language and Country of Origin		
9	**2.3.1**	Language of bid is *English*
10	**2.3.4**	The price quoted shall be in Pak rupees. *[Specify whether price of incidental services, must be quoted in addition to delivered duty paid (DDP) price.]* ***[The related provisions shall be reflected accordingly in SCC and Price Schedules.****]*
11.	**2.3.4**	*[Please expressly mention that the price shall be fixed].*
12.	**2.1.4 (ii)**	Country of origin: *Pakistan*
D. Preparation and Submission of Bids		
13.	**2.1.3**	Qualification Criteria / Knock-down criteria. i. The interested bidders must be registered with PEC in the category C-6 or above with valid registration certificates ii. Bidders must have completed and/or substantial projects related to water supply or of similar nature and complexity as main contractor with the value of Rupees 25 Million during the last five years with any authority or government or private sector along with authenticated proof including letter of award and completion certificate. iii. Valid NTN certificate as taxpayer with FBR shall also be required iv. Average annual construction turnover of the last three years must be 25 Million.

		v. The bidders must enclose the bid security of amount PKR 450,000/- (3% of the estimated cost of PKR 15 million) in favor of The Urban Sector Planning and Management Services Unit Pvt. Ltd. vi. The bidding document, including specifications and terms & conditions, is accessible on the Punjab Procurement Regulatory Authority (PPRA) and the company's websites. This is a draft document and shall not be used by any firm for the submission of their respective bids. The original reference document shall be purchased from the procuring agency after the submission of the tender fee of PKR 2000/- (non-refundable), by submitting a written request on the bidder's letterhead.
14.	**2.3.6&2.3.7**	N.A.
15.	**2.2.2**	Bid shall be submitted to: *The Urban Unit* *503 – Shaheen Complex, Egerton Road, Lahore* *Ph: 042-99205316-22* *Fax: 042-99205323* *www.urbanunit.gov.pk*
16.	**2.4.2**	The deadline for Bid submission is: a) Day: Monday b) Date: 26th August, 2024 c) Time: 11:00 AM
17.	**2.5.1**	Bid opening detail: a) Day: Monday b) Date: 26th August, 2024 c) Time: 11:30 AM Address: The Urban Unit, Office 503, Shaheen Complex, Egerton Road, Lahore.

18.	**2.6.2**	Amount of Performance Guarantee Performance Security in the form of Bank Guarantee or (Pay Order / Bank Draft / Call Deposit Receipts) from a schedule bank as per State Bank of Pakistan in favor of "Urban Sector Planning and Management Services Unit (Private) Limited" equivalent to 10% of the total contract/ purchase order amount shall be submitted by the successful bidder right after delivery of items, but no later than 7 working days, for a period of 6 (six) Months.
19.	**2.3.8**	**The estimated amount of Project is: PKR 15 Million** **Amount of Bid security is: 450,000 PKR (3% of estimated cost of 15 million)**
20.	**2.3.9**	Bid validity period after opening of the Bid is: 120 Days
21.	**2.3.9**	Number of copies of the Bid to be provided are: 3 Copies
E. Opening and Evaluation of Bids		
22.	**2.5.1**	**Bid opening detail:**
		a) Day: Monday b) Date: 26th August, 2024 c) Time: 11:30 AM **Address:** The Urban Unit, Office 503, Shaheen Complex, Egerton Road, Lahore.
23.	**2.3.5**	The currency that shall be used for Bid evaluation and comparison purposes to convert all Bid prices expressed in various currencies is: Pakistani Rupee (PKR) The source of exchange rate shall be: N/A The date of exchange rate shall be: N/A
F. Bid Evaluation Criteria		

24.	**2.5.8**	Criteria to Bid evaluation. Bidder who will not qualify the Eligibility/ Mandatory criteria shall not be technically evaluated. Evaluation criteria is given below
25.		Completion time for this project is of 45 days

Model/ Tentative Evaluation Criteria may, inter alia, contain the following:

Sr. No.	Description	Allocated Marks	Total Marks
1	**Company Profile, Experience & International Certifications if any.**		
i.	**Company Profile** Years of operations (From Registration date of NTN / FBR) ● E.g.: One (1) mark for one (1) year experience may be awarded. ● Maximum marks may be awarded, if the firm has 10 years or more experience.	*10*	
ii.	**Relevant Experience** Similar assignments / supplies over last 05 years. 2 marks per similar project, upto a total of 5 projects and 10 total marks **Purchase orders / supply orders / completion certificates must be attached, otherwise, no marks shall be awarded.**	*10*	
iii.	**Value of Projects** Capital Cost of similar projects / Supplies completed over last 05 years **If the total value is equal to or more than PKR *25 million*** For one project= 5 marks For two projects = 10 marks For three projects = 15 **Purchase orders / supply orders / completion certificates must be attached, otherwise, no marks shall be awarded.**	*15*	
2	**Financial Position**		
i.	**Annual Turnover (last 3 years)** **If the total annual turnover indicated in audit report/tax return of last three years is equal or above PKR: *25 Million* then maximum allocated marks may be awarded.**	*15*	

	If total turnover during last three years is upto PKR *25 Million* = 15 marks If total turnover during last three years is upto PKR *20 Million* = 10 marks If total turnover during last three years is upto PKR *15 Million = 5 marks* **Audit statement of last three financial years must be attached, otherwise, no marks shall be awarded.**		
ii.	**Tax Return** Active Tax Payer for Financial Year 2023-24	*10*	
iii.	**Bank Balance / Credit Limit** If bank balance / credit limit up-to Date is equal to or more than estimated cost of current purchase, full marks may be awarded. Otherwise, the marks may be awarded as: Closing Balance or Credit Limit x 05 Estimate of Current Purchase	*10*	
3.	**Human Resource**		
i	**Total HR strength of firm / company (Payroll of June 2024 mandatory)** *[the procuring agency should devise a mechanism for the allocation of marks to HR strength keeping in view the nature and requirement of procurement.]* **List of staff will be provided by Bidder with necessary details. (Admin, Accounts, B.D, HR manager, IT, 2 marks each)** *[The proof of registration with PEC/PPC/PMDC/PNC/PESSI/ EOBI etc. may be obtained as may be required keeping in view the nature of the procurement transaction.]*	*10*	
i	**List of Technical Staff** ● Technical staff having Bachelor/Technical Qualification. (Public Health, Civil, Q.S) ● *05* marks for each Associate person. **In case of medical field related projects, training certificates may be required by the procuring agency with the bid.**	*15*	
4.	**Offices/infrastructure**		
	Main Head Office **Required details are as under:-**	*5*	

	Complete address, ownership / rent agreement, years of office established on the same place. In case of missing information, no mark may be awarded.		
		Total	**100**

Only Bidders who have passed eligibility shall be marked as per criteria above.

Only the Bids securing minimum 60% marks would be declared technically accepted. *[Note 1:- If sample needs to be submitted, then details required]*
[Note 2:- The above is just a specimen which can be molded keeping in view the specific needs and provisions of PPR-14]

G. Award of Contract

2.6.5	Percentage for quantity increase or decrease is: [*Insert percentage, but not more/ less than 10%*].
2.6.2	The Performance Guarantee shall be: 10% of the contract/purchase order amount.
2.6.2	Performance Security in the form of Bank Guarantee or (Pay Order / Bank Draft / Call Deposit Receipts) from a schedule bank as per State Bank of Pakistan in favor of "Urban Sector Planning and Management Services Unit (Private) Limited" equivalent to 10% of the total contract/ purchase order amount shall be submitted by the successful bidder right after delivery of items, but no later than 7 (seven) days, for a period of 6 (six) Months.

Section-V: General Conditions of Contract

[The Procuring Agency should formulate General Condition of Contract in accordance with PPR-14 keeping in view its requirements, nature of procurement i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable) However, for a standard procurement/contract contents of a generalized General Conditions of Contract may be as follows:]

1. Definitions	1.1 In this Contract, the following terms shall be interpreted as indicated: (a) "The Contract" means the agreement entered into between the Procuring Agency and the Supplier, as recorded in the Contract Form signed by the parties, including all attachments and appendices thereto and all documents incorporated by reference therein. (b) "The Contract Price" means the price payable to the Supplier under the Contract for the full and proper performance of its contractual obligations. (c) "The Goods" means all of the equipment, machinery, and/or other materials which the Supplier is required to supply to the Procuring Agency under the Contract. (d) "The Services" means those services ancillary and related to the supply of the Goods, such as transportation and insurance, and any other incidental services, such as installation, commissioning, provision of technical assistance, training, maintenance & repair and other such obligations of the Supplier covered under the Contract. (e) "GCC" means the General Conditions of Contract contained in this section. (f) "SCC" means the Special Conditions of Contract. (g) "The Procuring Agency" means the organization purchasing the Goods & Services, as named in SCC. (h) "The Procuring Agency's country" is the country named in SCC. (i) "The Supplier" means the Bidder or firm supplying the Goods and Services under this Contract.

	(j) "The Project Site," where applicable, means the place or places named in SCC. (k) "Day" means calendar day.
2. Application	2.1. These General Conditions shall apply to the extent that they are not superseded by provisions of other parts of the Contract.
3. Country of Origin *[where applicable]*	3.1. All Goods and Services supplied under the Contract shall have their origin in the countries and territories eligible under the rules, as further elaborated in the SCC. 3.2. For purposes of this Clause, "origin" means the place where the Goods were mined, grown, or produced, or from where the Services are supplied. Goods are produced when, through manufacturing, processing, or substantial and major assembly of components, a commercially recognized new product is obtained that is substantially different in basic characteristics or in purpose or utility from its components. 3.3. The origin of Goods and Services is distinct from the nationality of the Supplier. In any case, the requirements of rules 10 & 26, PPR-14, shall be followed.
4. Standards	4.1. The Goods supplied under this Contract shall conform to the standards mentioned in the Technical Specifications, and, when no applicable standard is mentioned, to the authoritative standards appropriate to the Goods' country of origin. Such standards shall be the latest issued by the concerned institution.
5. Use of Contract Documents and Information; Inspection and Audit by the procuring agency.	5.1. The Supplier shall not, without the Procuring Agency's prior written consent, disclose the Contract, or any provision thereof, or any specification, plan, drawing, pattern, sample, or information furnished by or on behalf of the Procuring Agency in connection therewith, to any person other than a person employed by the Supplier in the performance of the Contract. Disclosure to any such employed person shall be made in confidence and shall extend only so far as may be necessary for purposes of such performance. 5.2. The Supplier shall not, without the Procuring Agency's prior written consent, make use of any document or information enumerated in GCC Clause 5.1 except for purposes of executing the Contract. 5.3. Any document, other than the Contract itself, enumerated in GCC Clause 5.1 shall remain the property of the Procuring Agency and shall be

	returned (all copies) to the Procuring Agency on completion of the Supplier's performance under the Contract if so required by the Procuring Agency. 5.4. The Supplier shall permit the Procuring Agency to inspect the Supplier's accounts and records relating to the performance of the Supplier and to have them audited by auditors appointed by the donors, if so required by the donors.
6. Patent Rights	6.1. The Supplier shall indemnify the Procuring Agency against all third-party claims of infringement of patent, trademark, or industrial design rights arising from use of the Goods or any part thereof in the Procuring Agency's country.
7. Performance Guarantee	7.1. Within 07 (seven) days of receipt of the notification of Contract award/purchase order, the successful Bidder shall furnish to the Procuring Agency the Performance Guarantee in the amount specified in SCC/Bid Data Sheet & clause 2.6.2 of ITB. 7.2. The proceeds of the Performance Guarantee shall be payable to the Procuring Agency as compensation for any loss resulting from the Supplier's failure to complete its obligations under the Contract. 7.3. As per Rule-56 of PPR-14, the performance guarantee shall be denominated in the currency of the Contract acceptable to the Procuring Agency and shall be in one of the following forms: (a) a bank guarantee or an irrevocable letter of credit issued by a reputable bank located in the Procuring Agency's country, in the form provided in the Bidding documents or another form acceptable to the Procuring Agency; or (b) a Bank Guarantee, Bank call-deposit (CDR), Demand Draft (DD), Pay Order (PO) or Banker's cheque cashier's or certified cheque or CDR. 7.4. The performance guarantee will be discharged by the Procuring Agency and returned to the Supplier not later than 07 (seven) days following the date of completion of the Supplier's performance obligations under the Contract, including any warranty obligations, unless specified otherwise in SCC.
8. Inspections and Tests	8.1. The Procuring Agency or its representative shall have the right to inspect and/or to test the Goods to confirm their conformity to the Contract specifications at no extra cost to the Procuring Agency. SCC and the Technical Specifications shall specify what inspections and tests the Procuring Agency requires and where they are to be conducted. The Procuring Agency shall

	notify the Supplier in writing, in a timely manner, of the identity of any representatives nominated for these purposes. 8.2. The inspections and tests may be conducted on the premises of the Supplier or its subcontractor(s), at point of delivery, and/or at the Goods' final destination. If conducted on the premises of the Supplier or its subcontractor(s) (if so allowed by the Procuring Agency), all reasonable facilities and assistance, including access to drawings and production data, shall be furnished to the inspectors at no charge to the Procuring Agency. 8.3. Should any inspected or tested Goods fail to conform to the Specifications, the Procuring Agency may reject the Goods, and the Supplier shall either replace the rejected Goods or make alterations necessary to meet specification requirements free of cost to the Procuring Agency. 8.4. The Procuring Agency's right to inspect, test and, where necessary, reject the Goods after the Goods' arrival in the Procuring Agency's country shall in no way be limited or waived by reason of the Goods having previously been inspected, tested, and passed by the Procuring Agency or its representative prior to the Goods' shipment from the country of origin. 8.5. Nothing in GCC Clause 8 shall in any way release the Supplier from any warranty or other obligations under this Contract.
9. Packing	9.1. The Supplier shall provide such packing of the Goods as is required to prevent their damage or deterioration during transit to their final destination, as indicated in the Contract. The packing shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage. Packing case size and weights shall take into consideration, where appropriate, the remoteness of the Goods' final destination and the absence of heavy handling facilities at all points in transit. 9.2. The packing, marking, and documentation within and outside the packages shall comply strictly with such special requirements as shall be expressly provided for in the Contract, including additional requirements, if any, specified in SCC, and in any subsequent instructions ordered by the Procuring Agency.
10. Delivery and Documents *[in case of Framework Modality the*	10.1. Delivery of the Goods shall be made by the Supplier in accordance with the terms specified in the Schedule of Requirements. The details of shipping and/or other documents to be furnished by the Supplier are specified in SCC.

Procuring Agency may amend these condition as per its requirements]	10.2. Upon delivery, the Procuring Agency shall give receiving certificate to the supplier with the statement that, "completion certificate along with satisfactory report shall be issued after due inspection as per clause-8 of GCC, which will enable the supplier to put up the bill". *[Further conditions may be incorporated by the Procuring Agency keeping in view the nature of contract, DDP, CIF, C&F, FOR, FOP for example; for a DDP contract the clause may be as follows:].* 10.3. For purposes of the Contract, DDP trade term used to describe the obligations of the parties shall have the meanings assigned to them by the current edition of *Incoterms* 10.4. Documents to be submitted by the Supplier are specified in SCC.
11. Insurance *[If required and decided by the Procuring Agency]*	11.1. The Goods supplied under the Contract shall be delivered *[form of content to be decided by the Procuring Agency]* duty form paid under which risk is transferred to the buyer after having been delivered, hence *[details coverage to be decided by the Procuring Agency]* is sellers responsibility.
12. Transportation	12.1. The Supplier is required under the Contract to transport the Goods to a specified place of destination within the Procuring Agency's country, including *(details to be decided by Procuring Agency as per requirement)* insurance and storage, as shall be specified in the Contract, and related costs shall be included in the Contract Price.
13. Incidental Services *[If required and decided by the Procuring Agency]*	13.1. The Supplier may be required to provide any or all of the following services, including additional services, if any, specified in SCC: (a) satisfactory performance for specified time/ quantity on-site and/or supervision of on-site assembly and/or start-up of the supplied Goods; (b) furnishing of tools required for assembly and/or maintenance of the supplied Goods; (c) furnishing of a detailed operations and maintenance manual for each appropriate unit of the supplied Goods; (d) performance or supervision or maintenance and/or repair of the supplied Goods, for a period of time agreed by the parties,

	provided that this service shall not relieve the Supplier of any warranty obligations under this Contract; and (e) training of the Procuring Agency's personnel, at the Supplier's plant and/or on-site, in assembly, start-up, operation, maintenance, and/or repair of the supplied Goods. 13.2. Prices charged by the Supplier for incidental services shall be included in the Contract Price for the Goods and shall not exceed: (i) the prevailing rates charged for other parties by the Supplier for similar services; and (ii) original price of goods.
14. Spare Parts *[If required and decided by the Procuring Agency]*	14.1. As specified in SCC, the Supplier may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the Supplier: (a) such spare parts as the Procuring Agency may choose to purchase from the Supplier, provided that this choice shall not relieve the Supplier of any warranty obligations under the Contract; and (b) in the event of termination of production of the spare parts: (i) advance notification to the Procuring Agency of the pending termination, in sufficient time to permit the Procuring Agency to procure needed requirements; and (ii) following such termination, furnishing at no cost to the Procuring Agency, the blueprints, drawings, and specifications of the spare parts, if requested.
15. Warranty	15.1. The Supplier warrants that the Goods supplied under the Contract are new, unused, of the most recent or current models selected by the Procuring Agency, and that they incorporate all recent improvements in design and materials unless provided otherwise in the Contract. The Supplier further warrants that all Goods supplied under this Contract shall have no defect, arising from design, materials, or workmanship (except when the design and/or material is required by the Procuring Agency's specifications) or from any act or omission of the Supplier, that may develop under normal use of the supplied Goods in the conditions prevailing in the country of final destination. 15.2. This warranty shall remain valid for _____ *[to be decided by the Procuring Agency]* year/months after the Goods, or any portion thereof as

	the case may be, have been delivered to and accepted at the final destination indicated in the Contract, or for _____ *[to be decided by the Procuring Agency]* year/months after the date of shipment from the port or place of loading in the source country, whichever period concludes earlier, unless specified otherwise in SCC. 15.3. The Procuring Agency shall promptly notify the Supplier in writing of any claims arising under this warranty. 15.4. Upon receipt of such notice, the Supplier shall, within the period specified in SCC and with all reasonable speed, repair or replace the defective Goods or parts thereof, without costs to the Procuring Agency. 15.5. If the Supplier, having been notified, fails to rectify the defect(s) within the period specified in SCC, within a reasonable period, the Procuring Agency may proceed to take such remedial action as may be necessary, at the Supplier's risk and expense and without prejudice to any other rights which the Procuring Agency may have against the Supplier under the Contract/relevant provision of PPR-14 including Blacklisting.
16. Payment	16.1. The method and conditions of payment to be made to the Supplier under this Contract shall be specified in SCC. 16.2. The Supplier's request(s) for payment shall be made to the Procuring Agency in writing, accompanied by an invoice describing, as appropriate, the Goods delivered and Services performed, and by documents submitted pursuant to GCC Clause 10, and upon fulfillment of other obligations stipulated in the Contract. 16.3. As per rule-62 of PPR-14, payments shall be made promptly by the Procuring Agency, but in no case later than thirty (30) days after submission of an invoice or claim by the Supplier, provided the work is satisfactory. 16.4. The currency of payment is *[to be decided by the Procuring Agency]*
17. Prices	17.1. Prices charged by the Supplier for Goods delivered and Services performed under the Contract shall not vary from the prices quoted by the Supplier in its Bid, with the exception of any price adjustments authorized in SCC.

18. Change Orders	18.1. The Procuring Agency may at any time, by a written order given to the Supplier pursuant to GCC Clause 31, make changes within the general scope of the Contract, only if required for the successful completion of the job, in any one or more of the following: (a) drawings, designs, or specifications, where Goods to be furnished under the Contract are to be specifically manufactured for the Procuring Agency; (b) the method of shipment or packing; (c) the place of delivery; and/or (d) the Services to be provided by the Supplier. 18.2. If any such change causes an increase or decrease in the cost of, or the time required for, the Supplier's performance of any provisions under the Contract, an equitable adjustment shall be made in the Contract Price or delivery schedule, or both, and the Contract shall accordingly be amended. Any claims by the Supplier for adjustment under this clause must be asserted within thirty (30) days from the date of the Supplier's receipt of the Procuring Agency's change order. But, in no case, the overall impact of the change should exceed 15% of the contract cost and no provisions of PPR-14 should be violated.
19. Contract Amendments	19.1. Subject to GCC Clause 18, no variation in or modification of the terms of the Contract shall be made except by the mutual consent through written amendment signed by the parties. No variation in finalized brands/ makes/models shall be allowed except in special conditions where the manufacturer has stopped producing or suspended that model or the latest model of similar series or version has been launched by the manufacturer or non-availability due to international mergers of the manufacturers or similar unavoidable constraints.
20. Assignment	20.1. The Supplier shall not assign the whole of contract to anybody else. However, some parts of contract or its obligations may be assigned to sub-contractors with the prior written approval of the procuring agency.
21. Sub-contracts	21.1. The Supplier shall notify the Procuring Agency in the Bid of all subcontracts to be assigned under this Contract. Such notification, in the original Bid or later, shall not relieve the Supplier from any liability or obligation under the Contract. 21.2. Subcontracts must comply with the provisions of GCC Clause 20.

22. Delays in the Supplier's Performance	22.1. Delivery of the Goods and performance of Services shall be made by the Supplier in accordance with the time schedule prescribed by the Procuring Agency in the Schedule of Requirements. 22.2. If at any time during performance of the Contract, the Supplier or its subcontractor(s) should encounter conditions impeding timely delivery of the Goods and performance of Services, the Supplier shall promptly notify the Procuring Agency in writing of the fact of the delay, its likely duration and its cause(s). As soon as practicable after receipt of the Supplier's notice, the Procuring Agency shall evaluate the situation and may at its discretion extend the Supplier's time for performance, with or without liquidated damages, in which case the extension shall be ratified by the parties by amendment of Contract. 22.3. Except as provided under GCC Clause 25, a delay by the Supplier in the performance of its delivery obligations shall render the Supplier liable to the imposition of liquidated damages pursuant to GCC Clause 23, unless an extension of time is agreed upon pursuant to GCC Clause 22.2 without the imposition of liquidated damages.
23. Liquidated Damages	23.1. Subject to GCC Clause 25, if the Supplier fails to deliver any or all of the Goods or to perform the Services within the period(s) specified in the Contract, the Procuring Agency shall, without prejudice to its other remedies under the Contract, deduct from the Contract Price, as liquidated damages, a sum equivalent to the percentage specified in SCC of the delivered price of the delayed Goods or unperformed Services for each week or part thereof of delay until actual delivery or performance, up to a maximum deduction of the percentage specified in SCC. Once the maximum is reached, the Procuring Agency may consider termination of the Contract pursuant to GCC Clause 24 along with other remedies available under PPR-14.
24. Termination for Default	24.1. The Procuring Agency, without prejudice to any other remedy for breach of Contract, by written notice of default sent to the Supplier, may terminate this Contract in whole or in part: (a) if the Supplier fails to deliver any or all of the Goods within the period(s) specified in the Contract, or within any extension thereof granted by the Procuring Agency pursuant to GCC Clause 22; (b) if the Supplier fails to perform any other obligation(s) under the Contract; or (c) if the Supplier, in the judgment of the Procuring Agency has engaged in corrupt practices in competing for or in executing the

	Contract. For the purpose of this clause, corrupt practices will be defined as per Section-2 (d) of The PPRA Act, 2009. *"Corrupt practices" in respect of procurement process, shall be as given in S-2 (d) of PPRA, Act, 2009:* *(d) "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value to influence the action of a public official, bidder or Contractor in the procurement process or in Contract execution to the detriment of the procuring agency; or misrepresentation of facts in order to influence a procurement process or the execution of a Contract, collusive practices among bidders (prior to or after bid submission) designed to establish bid prices at artificial, noncompetitive levels and to deprive the procuring agency of the benefits of free and open competition and any request for, or solicitation of anything of value by any public official in the course of the exercise of his duty; it may include any of the following:* *vi. coercive practice by impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence the actions of a party to achieve a wrongful gain or to cause a wrongful loss to another party;* *vii. collusive practice by arrangement between two or more parties to the procurement process or Contract execution, designed to achieve with or without the knowledge of the procuring agency to establish prices at artificial, noncompetitive levels for any wrongful gain;* *viii. offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence the acts of another party for wrongful gain;* *ix. any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;* *x. obstructive practice by harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in a procurement process, or affect the execution of a Contract or deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements before investigators in order to materially impede an investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or acts intended to materially impede the exercise of inspection and audit process* 24.2. In the event the Procuring Agency terminates the Contract in whole or in part, pursuant to GCC Clause 24.1, the Procuring Agency may procure, upon such terms and in such manner as it deems appropriate, Goods or Services similar to those undelivered, and the Supplier shall be liable to the Procuring Agency for any excess costs for such similar Goods or Services. However, the Supplier shall continue performance of the Contract to the extent not terminated.

25. Force Majeure	25.1. Notwithstanding the provisions of GCC Clauses 22, 23, and 24, the Supplier shall not be liable for forfeiture of its Performance Guarantee, liquidated damages, or termination for default if and to the extent that its delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure. 25.2. For purposes of this clause, "Force Majeure" means an event beyond the control of the Supplier and not involving the Supplier's fault or negligence and not foreseeable. Such events may include, but are not restricted to, acts of the Procuring Agency in its sovereign capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes. Both, the Procuring Agency and the Supplier, may agree to exclude certain widespread conditions e.g: epidemics, pandemics, quarantine restrictions etc from the purview of "Force Majeure". 25.3. If a Force Majeure situation arises, the Supplier shall promptly notify the Procuring Agency in writing of such condition and the cause thereof. Unless otherwise directed by the Procuring Agency in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event. Any difference of opinion concerning "Force Majeure" may be decided through means given herein below.
26. Termination for Insolvency	26.1. The Procuring Agency may at any time terminate the Contract by giving written notice to the Supplier if the Supplier becomes bankrupt or otherwise insolvent. In this event, termination will be without compensation to the Supplier, provided that such termination will not prejudice or affect any right of action or remedy which has accrued or will accrue thereafter to the Procuring Agency.
27. Termination for Convenience	27.1. The Procuring Agency, by written notice sent to the Supplier, may terminate the Contract, in whole or in part, at any time for its convenience. The notice of termination shall specify that termination is for the Procuring Agency's convenience, the extent to which performance of the Supplier under the Contract is terminated, and the date upon which such termination becomes effective. 27.2. The Goods that are complete and ready for shipment (if applicable) within thirty (30) days after the Supplier's receipt of notice of termination shall be accepted by the Procuring Agency on the Contract terms and prices. For the remaining Goods, the Procuring Agency may choose: (a) to have any portion completed and delivered at the Contract terms and prices; and/or

	(b) to cancel the remainder and pay to the Supplier an agreed amount for partially completed Goods and Services and for materials and parts previously procured by the Supplier.
28. Resolution of Disputes	28.1. After signing the contract or issuance of purchase order, The Procuring Agency and the Supplier shall make every effort to resolve amicably by direct informal negotiation any disagreement or dispute arising between them under or in connection with the Contract. 28.2. If, after thirty (30) days from the commencement of such informal negotiations, the Procuring Agency and the Supplier have been unable to resolve amicably a Contract dispute, either party may require that the dispute be referred for resolution to the formal mechanisms specified in SCC. These mechanisms may include, but are not restricted to, conciliation mediated by a third party, adjudication in an agreed and/or arbitration as per rule 68 of PPR-14 and in accordance with Arbitration Act-1940.
29. Governing Language	29.1. The Contract shall be written in the language specified in SCC. Subject to GCC Clause 30, the version of the Contract written in the specified language shall govern its interpretation. All correspondence and other documents pertaining to the Contract which are exchanged by the parties shall be written in the same language.
30. Applicable Law	30.1. The Contract shall be interpreted in accordance with the laws of Punjab (Pakistan) unless otherwise specified in SCC.
31. Notices	31.1. Any notice given by one party to the other pursuant to this Contract shall be sent to the other party in writing or by any information technology mean for the time being in use and acceptable in ordinary course of business to the other party's address specified in SCC. 31.2. A notice shall be effective when delivered or on the notice's effective date, whichever is later.
32. Taxes and Duties	32.1. Supplier shall be entirely responsible for all taxes, duties, license fees, etc., incurred until delivery of the contracted Goods & Services to the Procuring Agency. In case of imposition of new taxes/duties or concession thereof after the deadlines for the submission of bids the effect thereof shall be borne or availed by the procuring agency as the case may be.

Section-VI. Special Conditions of Contract

Special Conditions of Contract

The following Special Conditions of Contract shall supplement the General Conditions of Contract. Whenever there is a conflict, the provisions herein shall prevail over those in the General Conditions of Contract. The corresponding clause number of the GCC is indicated in parentheses.

[Instructions for completing the Special Conditions of Contract are provided, as needed, in the notes in italics mentioned for the relevant SCC. Where sample provisions are furnished, they are only illustrative of the provisions that the Procuring Agency should draft specifically for each procurement. The number of SCC may increase/ vary depending on specific requirements of a specific contract.]

1. Definitions (GCC Clause 1)

GCC 1.1 (g)—The Procuring Agency is: URBAN SECTOR PLANNING & MANAGEMENT SERVICES UNIT (PRIVATE) LIMITED

GCC 1.1 (h)—The Procuring Agency's country is: Pakistan

GCC 1.1 (i)—The Supplier is:

Sample Provision

GCC 1.1 (j)—The Project Site is: Murree Tehsil, Punjab, Pakistan

2. Country of Origin (GCC Clause 3)

Pakistan

3. Performance Guarantee (GCC Clause 7)

10 % of Contract/Purchase order Price.

4. Inspections and Tests (GCC Clause 8)

GCC 8.6—Inspection and tests prior to shipment of Goods and at final acceptance are as follows:

I. Food Grade Material Tests
II. Water Leakage and Water Proofing Tests
III. Water Quality Tests

Note: The contractor shall submit the required test results from the specified laboratories (PCSIR and/or other competent public sector laboratory) prior to installation, consumption or commissioning of material and/or items to the procuring agency.

5. Packing (GCC Clause 9)

N.A.

6. Delivery and Documents

N.A.

Sample provision (DDP terms)

GCC 10.3—Upon shipment, the Supplier shall notify the Procuring Agency the full details of the shipment, including Contract number, description of Goods, quantity and usual transport document. The Supplier shall mail the following documents to the Procuring Agency:

(i) copies of the Supplier's invoice showing Goods' description, quantity, unit price, and total amount;
(ii) original and two copies of the usual transport document (for example, a negotiable bill of lading, a non-negotiable sea waybill, an inland waterway document, an air waybill, a railway consignment note, a road consignment note, or a multimodal transport document) which the buyer may require to take the goods;
(iii) copies of the packing list identifying contents of each package;
(iv) insurance certificate;
(v) Manufacturer's or Supplier's warranty certificate;
(vi) Where applicable (Pre shipment/ port/ Procuring Agency Delivery site, inspection certificate), issued by the Procuring Agency nominated inspection agency, and the Supplier's factory inspection report (Inspection type depends on the nature of procurement and volume of procurement); and
(vii) Certificate of origin.

[Other similar documents should be listed, depending upon the Incoterm provisions.]

7. Insurance

N.A.

GCC 11.1— The Goods supplied under the Contract shall be delivered duty paid (DDP) under which risk is transferred to the buyer after having been delivered, hence insurance coverage is sellers responsibility. Since the Insurance is sellers responsibility they may arrange appropriate coverage.

8. Incidental Services

N.A.

GCC 13.1—Incidental services to be provided are:

[Selected services covered under GCC Clause 13 and/or other should be specified with the desired features. The price quoted in the Bid price or agreed with the selected Supplier shall be included in the Contract Price.]

9. Spare Parts

(GCC Clause 14) N.A

GCC 14.1—Additional spare parts requirements are:

Sample provision

GCC 14.1—Supplier shall carry sufficient inventories to assure ex-stock supply of consumable spares for the Goods. Other spare parts and components shall be supplied as promptly as possible, but in any case within six (6) months of placing the order and opening the letter of credit.

10. Warranty

N.A.

11. Sample provision

GCC 15.2—In partial modification of the provisions, the warranty period shall be hours of operation or _____ months from date of acceptance/satisfactory installation of the Goods or (___) months from the date of shipment (if applicable), whichever occurs earlier. The Supplier shall, in addition, comply with the performance and/or consumption guarantees specified under the Contract. If, for reasons attributable to the Supplier, these guarantees are not attained in whole or in part, the Supplier shall, at its discretion, either:

(a) make such changes, modifications, and/or additions to the Goods or any part thereof as may be necessary in order to attain the contractual guarantees specified in the Contract at its own cost and expense and to carry out further performance tests in accordance with SCC 4,

or

(b) pay liquidated damages to the Procuring Agency in case of failure to meet the contractual guarantees. The rate of these liquidated damages shall be (_____).

[rate to be decided by the Procuring Agency but it should be reasonable]

GCC 15.4 & 15.5—The period for correction of defects in the warranty period is:

12. Payment (GCC Clause 16)

Sample provision

GCC 16.1—The method and conditions of payment to be made to the Supplier under this Contract shall be as follows:

Payment for Goods supplied: *[to be decided by the Procuring Agency as per rule-62 of PPR-14]*

Payment may be made in Pak. Rupees in the following manner: *(to be decided by the Procuring Agency)*

(i) Running Bill modality.

Note: The payments will be processed based on actual site measurements and inspections.

13. Prices (GCC Clause 17)

Sample provision

GCC 17.1—Prices shall be fixed and shall not be adjusted.

14. Liquidated Damages (GCC Clause 23)

GCC 23.1—Applicable rate:

Maximum deduction:

[Applicable rate shall not exceed one-half (0.5) percent per week, and the maximum shall not exceed ten (10) percent of the Contract Price after that Procuring Agency may proceed for the termination of contract along-with other remedies available under PPR-14.]

15. Resolution of Disputes (GCC Clause 28)

N.A

As per rule-68 of PPR-14, in the case of a dispute between the Procuring Agency and the Supplier, the dispute shall be referred for arbitration in accordance with the Arbitration Act

16. Governing Language (GCC Clause 29)

GCC 29.1—The Governing Language shall be: English

17. Applicable Law (GCC Clause 30)

GCC 30.1-The Contract shall be interpreted in accordance with the laws applicable in the jurisdiction of the province of Punjab (Pakistan):

18. Notices (GCC Clause 31)

GCC 31.1—Procuring Agency's address for notice purposes:

—Supplier's address for notice purposes:

Section-VII. Schedule of Requirements

Supply, Installation, Testing, Commissioning of Rooftop Rainwater Harvesting system in MC Muree 35 Nos. Households.

7.1 Schedule of Requirements

Shall be as prescribed in the BDS.

Supply, Installation, Testing, Commissioning of Rooftop Rainwater Harvesting system in MC Muree 35 Nos. Households.

Section-VIII: Sample Forms

[The Procuring Agency should formulate Sample Forms in accordance with PPR-14 keeping in view its requirements, nature of procurement i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable). However, for a standard procurement/contract, contents of generalized Sample Forms may be as follows.]

Notes on the Sample Forms

[11] The Procuring Agency must specify here the date from which the delivery schedule will start. That date should be either the date of contract award, or the date of contract signature, or the date of opening of letter of credit, or the date of confirmation of the Letter of Credit, as appropriate. The Bid Form should include only a cross-reference to this Schedule.

The Bidder shall complete and submit with its Bid the **Bid Form** and **Price Schedules** pursuant to ITB Clause 2.2.3 & 2.3.4 and in accordance with the requirements included in the Bidding documents.

When requested in the Bid Data Sheet, the Bidder should provide the **Bid Security**, either in the form included hereafter or in another form acceptable to the Procuring Agency, pursuant to ITB Clause 2.3.8

The **Contract Form**, when it is finalized at the time of contract award, should incorporate any corrections or modifications to the accepted Bid resulting from price corrections pursuant to ITB Clause 2.5.6 and GCC Clause 17, acceptable deviations e.g., payment schedule pursuant to GCC 16, spare parts pursuant to ITB Clause 2.3.6 & 2.3.7, or quantity variations pursuant to ITB Clause 2.6.5. The Price Schedule and Schedule of Requirements, deemed to form part of the contract, should be modified accordingly.

The **Performance Guarantee** and **Bank Guarantee for Advance Payment** forms should not be completed by the Bidders at the time of their Bid preparation. Only the successful Bidder will be required to provide Performance Guarantee and bank guarantee for advance payment in accordance with one of the forms indicated herein or in another form acceptable to the Procuring Agency and pursuant to GCC Clause 7.3 and SCC 10, respectively.

The **Manufacturer's Authorization** form should be completed by the Manufacturer, as appropriate, pursuant to ITB Clause 2.3.6(iii).

8.1 Bid Form

[To be signed & stamped by the Goods Provider and reproduced on the letter head. To be attached with the Bid, in case of Single Stage One Envelope Procedure and with the Financial Bid, in case of Single Stage Two Envelope Procedure]

Date: _____

To: ***[name and address of Procuring Agency]***

Gentlemen and/or Ladies:

Having examined the Bidding documents including Addenda Nos. *[insert numbers],* the receipt of which is hereby duly acknowledged, we, the undersigned, in conformity with the said Bidding documents for the sum of *[total Bid amount in words and figures]* or such other sums as may be ascertained in accordance with the Schedule of Prices attached herewith and made part of this Bid.

We undertake, if our Bid is accepted, specified in the Schedule of Requirements.

If our Bid is accepted, we will obtain the guarantee of a bank in a sum equivalent to percent of the Contract Price for the due performance of the Contract, in the form prescribed by the Procuring Agency.

We agree to a Bid by this Bid for a period of *[number]* days from the date fixed to Bid opening under Clause 2.3.8 of the Instructions to Bidders, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

Until a formal Contract is prepared and executed *(if required)*, this Bid, together with your written acceptance thereof and your notification of award, shall constitute a binding Contract between us.

[In case of single stage one envelope bidding procedure]

The Composition of our Bid is**:**

a) Complete bidding document (without filling) signed and stamped by the bidder

b) all the forms relevant to the technical and financial bids (clearly indicated on each form)

c) All the required documents establishing eligibility of bidders/goods shall be made part of the bid.

d) Any other document required by the procuring agency not inconsistent with PPR-14.

[In case of single stage two envelope bidding procedure],

The Composition of our bid consists on separate Technical and financial bids, detail of which is as follows:

Technical bid includes the following:-

a) Complete bidding document (without filling) signed and stamped by the bidder

b) All the forms relevant to the technical bid, to be reproduced on the letter head of the bidder as indicated on each individual form.

c) Copy of bid security form along with copy of financial instruments *[to be decided by the procuring agency i.e. Bank Guarantee / Bank call-deposit (CDR) / Demand Draft (DD) / Pay Order (PO) or Banker's cheque]* valid for …… ( ) Days, beyond the validity of Bid in the manner as prescribed on the bid security form **8.10**.

d) Any other document required by the procuring agency not inconsistent with PPR-14.

Financial bid includes the following:-

a) Original Bid form (as per **form 8.1 of** Bidding documents) on letter head of the firm, duly signed and stamped.

b) Price schedule / financial form (as per **form 8.10**) to be reproduced on the letter head of the bidder duly signed and stamped.

c) Original Bid security form (as per **form 8.11**) along with Original financial instrument *[to be decided by the procuring agency i.e. Bank Guarantee / Bank call-deposit (CDR) / Demand Draft (DD) / Pay Order (PO) or Banker's cheque]* valid for …… ( ) Days, beyond the validity of Bid.

d) *Any other document required by the procuring agency not inconsistent with PPR-14.*

Commissions or gratuities, if any, paid or to be paid by us to agents relating to this Bid, and to contract execution if we are awarded the contract, are listed below:

Name and address of goods provider	Amount and Currency	

(if none, state "none")

We understand that you are not bound to accept the lowest or any Bid you may receive.

Dated this _____ day of _____ 20_____.

_____ _____

[signature] *[in the capacity of]*

Duly authorized to sign Bid for and on behalf of _____

[The Procuring Agency should formulate Bid Form in accordance with PPR-14 keeping in view its requirements, nature of procurement. i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable). However, for a standard procurement/contract, contents of a generalized Bid Form may be as provided above.]

8.2 Bidder's JV Members Information Form

{To be reproduced and signed & stamped by the lead partner and all JV members on their letter Pad, to be attached with Technical Bid in addition to the JV agreement}

{The Bidder shall fill in this Form in accordance with the instructions indicated below. The following table shall be filled in for the Bidder and for each member of a Joint Venture}.
Date: *[insert date (as day, month and year) of Bid submission*]
RFB No.: *[insert number of RFB process]*
Alternative No.: *[insert identification No if this is a Bid for an alternative]*

Page _____ of_ _____ pages

1. Bidder's Name: *[insert Bidder's legal name]*
2. Bidder's JV Member's name: *[insert JV's Member legal name]*
3. Bidder's JV Member's country of registration: *[insert JV's Member country of registration]*
4. Bidder's JV Member's year of registration: *[insert JV's Member year of registration]*
5. Bidder's JV Member's legal address in country of registration: *[insert JV's Member legal address in country of registration]*
6. Bidder's JV Member's authorized representative information Name: *[insert name of JV's Member authorized representative]* Address: *[insert address of JV's Member authorized representative]* Telephone/Fax numbers: *[insert telephone/fax numbers of JV's Member authorized representative]* Email Address: *[insert email address of JV's Member authorized representative]*
7. Attached are copies of original documents of *[check the box(es) of the attached original documents]* ☐ Articles of Incorporation (or equivalent documents of constitution or association), and/or registration documents of the legal entity named above, in accordance with ITB 4.4. ☐ In case of a state-owned enterprise or institution, documents establishing legal and financial autonomy, operation in accordance with commercial law, and that they are not under the supervision of the Purchaser, in accordance with ITB 4.6.

8. Included are the organizational chart, a list of Board of Directors, and the beneficial ownership.

8.3. Manufacturer's Authorization Form

N.A.

To: *[name of the Procuring Agency]*

WHEREAS *[name of the Manufacturer],* who are established and reputable manufacturers of *[name and/or description of the goods]* having factories at *[address of factory]* do hereby authorize *[name and address of Agent]* to submit a Bid, and subsequently negotiate and sign the Contract with you against for the above goods manufactured by us.

We hereby extend our full guarantee and warranty as per Clause 15 of the General Conditions of Contract for the goods offered for supply by the above firm against this Invitation to Bids.

_____

[Signature for and on behalf of Manufacturer]

Note: This letter of authority should be on the letterhead of the Manufacturer and should be signed by a person competent and having the power of attorney to bind the Manufacturer. It should be included by the Bidder in its Bid.

8.4. Bidder Profile Form

[To be signed & stamped by the Bidder and reproduced on the letter head. To be attached with Technical Bid]

Sr.#	**Particulars**
1.	Name of the company:
2.	**Registered Office:**
Address:	
Office Telephone Number:	
Fax Number:	
3.	**Contact Person:**
Name:	
Personal Telephone Number:	
Email Address:	
4.	**Local office if any:**
Address:	
Office Telephone Number:	
Fax Number:	
5.	**Registration Details:**

a) Audited Financial Statement Attachment/Income Tax Returns (Last ____ years)

Yes	No

b) Details of Experience (Last _____ Years)

(i)	**Similar Project (Agency/Department)**	**Item Name**
(ii)	**Value of total Projects/Tenders/POs**	**Amount**

c) Staff Detail and last month Payroll

Yes	No

[The Procuring Agency should formulate Bidder Profile Form in accordance with PPR-14 keeping in view its requirements, nature of procurement i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable). However, for a standard procurement/contract, contents of a generalized Bidder Profile Form may be as provided above.]

8.5. General Information Form

[To be signed & stamped by the Bidder and reproduced on the letter head. To be attached with Technical Bid]

	Particulars			
Company Name				
Abbreviated Name				
National Tax No.			**Sales Tax Registration No**	
PRA Tax No.				
No. of Employees			**Company's Date of**	
			Formation	

*Please attach copies of NTN, GST Registration & Professional Tax Certificate

Registered Office		State/Province	
Address			
City/Town		Postal Code	
Phone		Fax	

Email Address		Website Address	

[The Procuring Agency should formulate General Information Form in accordance with PPR-14 keeping in view its requirements, nature of procurement i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable). However, for a standard procurement/contract, contents of a generalized General Information Form may be as provided above.]

8.6. Affidavit

[To be printed on PKR 100 Stamp Paper, duly attested by oath commissioner. To be attached with Technical Bid]

Name: _____

(Applicant)

I, the undersigned, do hereby certify that all the statements made in the Bidding document and in the supporting documents are true, correct and valid to the best of my knowledge and belief and may be verified by employer if the Employer, at any time, deems it necessary. The undersigned hereby authorize and request the bank, person, company or corporation to furnish any additional information requested by the *[name of Procuring Agency]* of the Punjab deemed necessary to verify this statement regarding my (our) competence and general reputation.

The undersigned understands and agrees that further qualifying information may be requested and agrees to furnish any such information at the request of the *[name of Procuring Agency]*. The undersigned further affirms on behalf of the firm that:

(i) The firm is not currently blacklisted by the Procuring Agency.

(ii) The documents/photocopies provided with Bid are authentic. In case, any fake/bogus document was found at any stage, the firm shall be blacklisted as per Law/ Rules.

(iii) Affidavit for correctness of information.

(iv) **********omitted******

[Name of the Contractor/ Bidder/ Supplier] undertakes to treat all information provided as confidential.

Signed by an authorized Officer of the company

Title of Officer: _____

Name of Company: _____

Date: _____

[The Procuring Agency may alter or modify the details of this form in accordance with PPR-14 keeping in view its requirements, nature of procurement i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable). However, for a standard procurement/contract, contents of a generalized this Form may be as provided above.]

8.7. Performance Guarantee Form

[To be signed & stamped by the Bidder and reproduced on the letter head. To be attached with Technical Bid]

To,

[name and address of the Procuring Agency]

WHEREAS (Name of the Contractor/ Supplier) _____ hereinafter called "the Contractor" has undertaken, in pursuance of **"**INVITATION TO BID FOR THE **"PROVISION OF _____"** procurement of the following:

1. [***Please insert details***].

(Here in after called "the Contract").

AND WHEREAS it has been stipulated by you in the Contract that the Contractor shall furnish you with a bank guarantee by a scheduled bank for the sum specified therein as security for compliance with the Contractor's performance obligations in accordance with the Contract;

AND WHEREAS we have agreed to give the Contractor a Guarantee;

THEREFORE WE hereby affirm that we are Guarantor and responsible to you, on behalf of the Contractor, up to a total of _____(Amount of the guarantee in words and figures), and we undertake to pay you, upon your first written demand declaring the Contractor to be in default under the Contract, and without cavil or argument, any sum or sums as specified by you, within the limits of _____(Amount of Guarantee) as aforesaid without your needing to prove or to show grounds or reasons for your demand or the sum specified therein.

This guarantee is valid until _____ day of _____, 20__, or _____ [insert number of days] after the rectification of the Defects, whichever is later.

[NAME OF GUARANTOR]

Signature_____

Name_____

Title _____

Address_____

Seal_____

Date_____

[The Procuring Agency may alter or modify the details of this form in accordance with PPR-14 keeping in view its requirements, nature of procurement i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable). However, for a standard procurement/contract, contents of a generalized this Form may be as provided above.]

8.8. Technical Bid Form

N.A.

Sr. No.	Item name	Brand name with Country of Manufacturer	Make & model	Quantity	Country of Origin	Specifications dimensions

Stamp & Signature of Bidder _____

[The Procuring Agency may alter or modify the details of this form in accordance with PPR-14 keeping in view its requirements, nature of procurement i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable). However, for a standard procurement/contract, contents of a generalized this Form may be as provided above.]

8.9. Contract Form

[To be signed & stamped by the Bidder and reproduced on the letter head. To be attached with Technical Bid]

THIS AGREEMENT made on the ____ day of _____ 20__ between *[name of Procuring Agency]* of *[country of Procuring Agency]* (hereinafter called "the Procuring Agency") on the one part and *[name of Supplier]* of *[city and country of Supplier]* (hereinafter called "the Supplier") on the other part:

WHEREAS the Procuring Agency invited Bids for certain goods and ancillary services, viz., *[brief description of goods and services]* and has accepted a Bid by the Supplier for the supply of those goods and services in the sum of *[contract price in words and figures]* (hereinafter called "the Contract Price").

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract referred to.

2. The following documents shall be deemed to form and be read and construed as part of this Agreement, viz.:

(a) the Bid Form and the Price Schedule submitted by the Bidder;
(b) the Schedule of Requirements;
(c) the Technical Specifications;
(d) the General Conditions of Contract;
(e) the Special Conditions of Contract; and
(f) the Procuring Agency's Notification of Award.
(g) Contract agreement
(h) Complete Bidding document

3. In consideration of the payments to be made by the Procuring Agency to the Supplier as hereinafter mentioned, the Supplier hereby covenants with the Procuring Agency to provide the goods and services and to rectify defects therein in conformity with all respects in accordance with the provisions of the Contract.

4. The Procuring Agency hereby covenants to pay the Supplier in consideration of the provision of the goods and services and the rectification of defects therein, the Contract Price or such other sum as may become payable under the provisions of the contract at the times and in the manner prescribed by the contract.

IN WITNESS whereof the parties hereto have caused this Agreement to be executed in accordance with their respective laws the day and year mentioned above.

Signed, sealed, delivered by _____ the _____ (for the Procuring Agency)

Signed, sealed, delivered by _____ the _____ (for the Supplier)

[The Procuring Agency should formulate Contract Form in accordance with PPR-14 keeping in view its requirements, nature of procurement i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable). However, for a standard procurement/contract, contents of a generalized Contract Form may be as provided above.]

8.10. Financial Bid Form/Price Schedule

[To be signed & stamped by the Bidder and reproduced on the letter head. To be attached with Financial Bid]

Project	Rooftop Rainwater Harvesting in MC Murree
Tender	Supply, Installation, Testing, Commissioning of 35 Rooftop Rainwater Harvesting System in MC Murree
Total Units	35 RWH Units (30 for Households & 5 Govt. Buildings)

Sr.	Item name	Size	Food Grade Tanks (Gallon)	Unit price (inclusive of all taxes & duties etc.)	Quantity	Total price (inclusive of all taxes & duties etc.)	Total price (in words)
1	RWH system complete in all respect as per BOQ & Specifications	3 Marla	300		10		
2	RWH system complete in all respect as per BOQ & Specifications	3 Marla	300		1		
3	RWH system complete in all respect as per BOQ & Specifications	4 Marla	500		12		
4	RWH system complete in all respect as per BOQ & Specifications	5 Marla	1000		7		
5	RWH system complete in all respect as per BOQ & Specifications	Govt Building	1000		5		
Total price in figures*							
Total price in words**							

**Total Bid value (against which a Bid shall be evaluated) in figure.*

***Total Bid value (against which a Bid shall be evaluated) in words.*

Note:

In case of difference between unit price and total price, unit price shall prevail and total price shall be "final". *(Please refer ITB clause 2.5.6).*

In case of difference between amount in "words" and amount in "figures", amount in "words" shall be considered final.

Stamp & Signature of Bidder _____

8.11. Bid Security Form

[To be signed & stamped by the Bidder and reproduced on the letter head. To be attached with Financial Bid]

Whereas *[name of the Bidder]* (hereinafter called "the Bidder") has submitted its Bid dated *[date of submission of Bid]* for the supply of *[name and/or description of the goods]* (hereinafter called "the Bid").

KNOW ALL PEOPLE by these presents that WE *[name of bank]* of *[name of country]*, having our registered office at *[address of bank]* (hereinafter called "the Bank"), are bound unto *[name of Procuring Agency]* (hereinafter called "the Procuring Agency") in the sum of for which payment well and truly to be made to the said Procuring Agency, the Bank binds itself, its successors, and assigns by these presents. Sealed with the Common Seal of the said Bank this _____ day of _____ 20____.

THE CONDITIONS of this obligation are:

1. If the Bidder withdraws its Bid during the period of Bid validity specified by the Bidder on the Bid Form; or

2. If the Bidder, having been notified of the acceptance of its Bid by the Procuring Agency during the period of Bid validity:

   (a) fails or refuses to execute the Contract Form, if required; or
   (b) fails or refuses to furnish the Performance Guarantee, in accordance with the Instructions to Bidders;

we undertake to pay to the Procuring Agency up to the above amount upon receipt of its first written demand, without the Procuring Agency having to substantiate its demand, provided that in its demand the Procuring Agency will note that the amount claimed by it is due to it, owing to

the occurrence of one or both of the two conditions, specifying the occurred condition or conditions.

This guarantee will remain in force up to and including thirty (30) days after the period of Bid validity, and any demand in respect thereof should reach the Bank not later than the above date.

_____

[Signature of the bank]

[The Procuring Agency may alter or modify the details of this form in accordance with PPR-14 keeping in view its requirements, nature of procurement i.e. Bulk/Framework, item wise/package wise and form of contract to be adopted (i.e. DDP, CIF, C&F, FOR, FOP etc. if applicable) However, for a standard procurement/contract contents of a generalized this Form may be as provided above.]

Section IX- Check List

[To be signed and stamped and presented on Bidder's letter head pad]

The provision of this checklist is essential prerequisite along with submission of tenders (with technical proposal).

Sr. #	Detail	Responsive	Non-responsive
1	Original receipt for purchase of tender along with Standard Bidding Documents.		
2	___% Bid Security of estimated cost of articles / items given by the department. The Bid security must be submitted with technical proposal.		
3	All required samples (if demanded) have been submitted in *[name of the Procuring Agency]* sample store.		
4	Active Registration with Income Tax Authorities (National Tax Number NTN) at least three years old		
5	Copy of active Registration with Sales Tax Authorities (STRN)		
6	Copy of active Registration (Professional Tax Certificate)		
7	Bidder s JV Member information as per **form 8.2**		
8	At least _____ of similar nature having similar cost or above have been performed / executed in public organization during last 02 years (certificate duly signed by gazetted officer attached).		
9	Technical Bid Form (as per **form 8.9** of Bidding documents) on letter head of the firm duly signed and stamped.		
10	Financial Bid Form (as per **form 8.1 of** Bidding documents) on letter head of the firm, duly signed and stamped.		
11	Bid Security Form (as per **form 8.11**of Bidding documents) on letter head of the firm, duly signed and stamped.		
12	Performance Guarantee Form (as per **form 8.7** of Bidding documents) on letter head of the firm, duly signed and stamped.		
13	General Information Form (as per **form 8.5** of Bidding documents) on letter head of the firm duly signed and stamped.		

14	Affidavit(as per **form 8.6**) on non-judicial Stamp Paper of Rs. 100/- (i) The firm is not currently blacklisted by the Procuring Agency. (ii) The documents/photocopies provided with Bid are authentic. In case of any fake/bogus document look at any stage. They shall be black listed as per Rules / Laws. (iii) Affidavit for correctness of information. (iv) ****omitted*** Affidavit for correction of information Form (as per **form** of Bidding documents) on letter head of the firm, duly signed and stamped.		
15	i. Work order / supply order / purchase order of previous relevant experience. ii. Company profile. Staff list along with location and address *[where applicable].* iii. Income Tax Returns/Audited Financial Statement, National tax number Certificate, General Sale Tax Number Certificate (last 03 year). iv. Bidders profile Form (as per **form** of Bidding documents) on letter head of the firm, duly signed and stamped.		

Stamp & Signature of Bidder _____

[The Procuring Agency may alter or modify the details of this form in accordance with PPR-14 keeping in view the nature and scope of the procurement and as per its requirements.]

PROJECT RAIN WATER
HARVESTING SYSTEM IN MURREE

SPECIFICATIONS OF PLUMBING WORKS

AUGUST, 2024

SECTION - 1

EXCAVATION, TRENCHING AND BACKFILLING

1.1 SCOPE

The work covered by this section of the Technical Specifications consists of furnishing all plant, labour, equipment, appliances, and the materials for performing all operations in connection with excavation, trenching and back-filling for water supply, sewerage and structures including all incidental works necessary for excavation to the required depth and dimensions in accordance with the applicable drawings, or as directed by the Engineer. The work shall be carried out in complete conformity with the specifications, setforth hereunder.

1.2 SETTING OUT

The Contractor shall set out the works in accordance with the dimensions, lines and levels shown on the Drawings. Where no precise positions or levels are shown on the drawings, the works shall be set out by the Contractor to the positions and levels determined by the Engineer's Representative as the work proceeds.

1.3 CLEARING AND GRUBBING

The sites of all excavations shall be cleared of all shrubs, plants, bushes, large roots, rubbish and other objectionable materials. All such materials shall be removed from site of work or otherwise disposed of at no extra cost in a manner satisfactory to the Engineer. All trees and shrubs that are designated by the Engineer to remain shall be adequately protected and preserved in an approved manner.

1.4 EXCAVATION

1.4.1 General

All excavation of whatever substance encountered shall be performed to the depths indicated or as otherwise specified. During excavation, material suitable for back-filling shall be stockpiled in an orderly manner at a sufficient distance from the banks of the excavation to avoid overloading and to prevent sides from caving. All excavated material unsuitable for backfill shall be removed and placed at a location approved by the Engineer. Grading shall be done as may be necessary to prevent surface water from flowing into the trenches or other excavations, and any water accumulated therein shall be removed by pumping or by other approved methods. Unless otherwise indicated or approved by the Engineer, excavation shall be open cut. For Contract purposes hereunder the

earth excavation work has been classified into two categories, earth excavation in trenches and earth excavation for structures.

1.4.2 Earth Excavation in Trenches

Unless otherwise directed or permitted by the Engineer not more than 100 ft of any trench in advance of the end of the pipeline already laid shall be opened at any time. Trenches shall be excavated to the dimensions and depths shown on the drawings or ordered by the Engineer or in such a position or to such dimensions and depths as shall allow for the proper construction of the relevant structure or proper excavation of the relevant operation. Pipe trenches shall be excavated to give a clear width of 6 inches on either side of the pipe. Additional excavation shall be carried out to give ample space for making joints and, where necessary, for concrete bedding or surround.

The banks of the pipe trench shall be as nearly vertical as practicable. Bell holes and depressions for joints shall be dug after the trench bottom has been prepared. The pipe, except for joints, shall rest on the prepared bottom for its full length. Bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joints. Stones shall be removed to avoid point bearing. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe as determined by the Engineer is encountered in the bottom of the trench, such material shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, or other suitable approved granular material. Such replacement of unsuitable material will be paid for at the contract unit price for that item of work as shall be agreed upon, before execution of this work, with the Engineer.

Where the Contractor has excavated to depths in excess of the requirements, from his neglect or from causes within his control, he shall refill and compact the excess excavation with suitable material approved by the Engineer, upto corrected level, at his own expense.

Excavation of appurtenances shall be sufficient to leave at least 12 inches but not more than 24 inches between the outer surface and the embankment or timber that may be used to hold and protect the banks. Any over-depth excavation below such appurtenances that has not been directed by the Engineer, will be considered un-authorized and shall be refilled with compacted sand, gravel or concrete, as directed by the Engineer and at no additional cost to the Employer.

1.4.3 Earth Excavation for Structures

All earth excavation under this contract, which is not included under the classification of "Earth excavation in Trenches" shall be classified and paid for as earth excavation for structures.

The Contractor shall provide adequate timbering or shoring for excavations,

should the sides and ends of any excavations give way the Contractor shall, at no extra cost, remove all disturbed ground. Any excavation carried outside the limits shown on drawings and specified herein as the payment limits, shall not be treated as excavated and shall not be paid for.

When foundation level or base of excavation is reached, the Engineer's representative will inspect the exposed ground and give directions as to what further excavation, if any, he considers necessary. The excavation should be done in such a manner, as to ensure that the work rests on a solid and perfectly clean foundation. If the Contractor allows any portion of such foundations to deteriorate due to exposure, he shall make good the foundation to the satisfaction of the Engineer without extra cost.

1.4.4 Replaced Soil under Foundations

1.4.4.1 Material

Selected well graded granular material shall be used for filling beneath the structural foundations. This material should meet the requirements of A-2-4 & A-3 (AASHTO soil classification).

The suitability of the material shall be supported by adequate tests in the laboratory.

1.4.4.2 Equipment and Procedure

Suitable equipment shall be selected by the Contractor on the basis of field trials for compaction. The contractor shall indicate his planning to carry out compaction in his Method Statement for Engineer's approval before undertaking actual compaction. A test section would be required to select the most suitable equipment, layer thickness, moisture content, No. of passes etc.

1.4.4.3 Compaction Standard

The contractor shall place the material to be compacted in layers. Each layer shall be of specified thickness and shall be compacted by the optimum number of passes as explained in above section. Compaction less than 75% of relative density or 95% of Modified Proctor Density shall not be acceptable.

1.4.4.4 Quality Control

Every compacted layer shall be tested for quality of compaction by performing in-situ density tests. Sand replacement method of density measurement shall be used. The evaluation of 75% relative density or 95% Modified Proctor Density shall be based on measurement of maximum, minimum and maximum Modified Proctor Densities in the laboratory. The frequency of this testing shall be instructed by the Engineer at the site.

1.5 PRECAUTIONARY AND REMEDIAL MEASURES

1.5.1 Protection of Existing Facilities and Structures

The Contractor shall take every necessary precaution not to endanger the safety, occupation or operation of any property, structures, installations or services in the vicinity of his operations and shall observe any restrictions imposed by the Authority concerned and the Engineer to this end. Should any such property, structures, installations or services be endangered or damaged as a result of the Contractor's operations, he shall immediately report any such danger or damage to the Engineer's Representative and any Authority concerned and shall forthwith undertake remedial measures to the satisfaction of the Engineer and the appropriate Authority with out additional cost.

1.5.2 Planking and Strutting

The Contractor shall provide at his own expense to the satisfaction of the Engineer all timbering, poling, shoring, strutting and other approved supports to the sides of all excavations, trenches and all other works in such a way as will be sufficient to secure them from falling and to prevent any movement. All responsibilities connected with this part of the work shall rest with the Contractor.

In removing timbering, shoring and strutting and all other supports from excavation and trenches, special care shall be taken to avoid pressure on fresh concrete or any other work until it is sufficiently safe to resist such pressure.

1.5.3 Dewatering

The Contractor shall build all drains and do ditching, pumping, well pointing, bailing, and all other work necessary to keep the excavation clear of ground water, sewage and storm water during the progress of the work and until the finished work is safe from injury. All water pumped or drained from the work shall be disposed of in a manner satisfactory to the Engineer and necessary precautions against flooding shall be taken. The procedure for dewatering of subsoil water from excavation for the purpose of construction of sewer lines and other structures shall be in accordance with the method given below:

- Dewatering of subsoil water from excavations of trenches and excavations for other structures shall be arranged by an adequate process of well-pointing, bailing and/or pumping or by any other suitable method approved by the Engineer on the basis of the method (statement to be submitted by the Contractor).

- If well-points are used then the following requirements shall be met with. Well-pointing shall consist of bore holes, provided with necessary strainers, blind pipes and pumping machinery, and these shall be of suitable size and depth and shall be located on both sides of the trench

and along the periphery of water level to a sufficient depth to keep the excavations clear of subsoil water during the process of construction.

- As a part of the work and at no extra cost, the Contractor shall provide all strainer pipes and other requisite material, and boring tools and plant, etc. for the well pointing and shall also provide pumping equipment as well as operating personnel, power, etc. Dewatering of subsoil water shall be continuous process round the clock during the progress of the work and until the finished work is safe, from injury to the complete satisfaction of the Engineer's representative and any interruption in continuous pumping and causing injury to the works done or under construction shall require the Contractor to repair or rebuild the works to the entire satisfaction of the Engineer's representative at no extra cost. No extra payment shall be made to the Contractor for the disposal of storm water and for dewatering in trenches and building structures less then 5 ft. depth.

1.5.4 Maintenance of Excavation

All excavation shall be properly maintained while open and exposed. Sufficient suitable barricades, warning lights, flood lights, reflective signs, and similar items shall be provided by the Contractor. The Contractor shall be responsible for any damage due to his negligence.

1.5.5 Surplus Materials

All surplus materials shall be disposed of at locations approved by the Engineer. The disposal of surplus material shall not interfere with other works and shall not damage or spoil other material. When it is necessary to haul earth or rock material over street or pavement, the Contractor shall prevent such material from falling on the street or pavement.

1.5.6 Cutting Pavement

In cutting or breaking street surfacing, the Contractor shall not use equipment which will damage the adjacent pavement. Existing paved surfaces shall be cut back beyond the edge of trenches to form neat square cuts. The road ballast, brick pavement, and other materials shall be placed on one side and shall be preserved for reinstatement when the trench is filled. Wherever necessary or required for the convenience of the public or individual residents, at street crossings and at private driveways, the Contractor shall provide suitable temporary bridges which shall be maintained in service until backfilling has been completed. The Contractor shall keep the road crossings manned 24 hours per day. During night time, enough red lights shall be provided to warn the traffic. If detour is necessary, the Contractor shall make proper detour for the traffic and shall install signs 3 ft. x 4 ft. in size indicating the detour.

1.6 TRANSPORTATION OF MATERIAL

All carts, trucks or other vehicles used by the Contractor for transportation of the material shall be suitably constructed or lined not to permit any leakage/spillage of soil while the vehicles are on the move. These would be so loaded and arranged as not to spill on the site and public roads. Whenever any vehicle so used is found leaking/spilling and unsuitable, it shall be immediately withdrawn from the work on notification by the Engineer.

1.7 COMPACTED FILL AND BACKFILL

1.7.1 General

After the completion of water and sewer lines, foundations, walls and other structures below the elevation of the final grade, all voids shall be backfilled with suitable materials, as specified below.

1.7.2 Backfilling for Structures

Backfilling operations for structures shall be performed as part of the Contractor's work under the payment items for earth excavation and at no extra cost to the Owner. It would comprise returning and filling the selected excavated material around foundations, and at back of walls etc., upto finished levels shown on the Drawings or as required in layers not exceeding 6 inches, carefully rammed and consolidated (with addition of water if required) so as to achieve a minimum relative density of 90% of modified proctor test at optimum moisture content. No fill shall be made until the concrete foundations and footings etc., have been inspected and approved by the Engineer. Earth to be used for filling must be free of all the organic impurities, debris or any other foreign matter. Earth which contains more than 1% of salts particularly sulphates will not be used in filling.

1.7.3 Backfilling of Trenches

The trenches shall not be completely backfilled until all required pressure tests are performed and until the water lines as installed conform to the requirements of specifications. Where in the opinion of the Engineer, damage is likely to result from withdrawing sheeting, shoring, the same shall be left in place and cut off at a level 1 ft. below ground surface. Sheeting left in place shall be paid for at the approved rate for that item of work. Trenches shall be backfilled to the ground surface with selected excavated material or other material that is suitable for proper compaction. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted to the specified density. The surface shall be restored to its original or better condition. Pavement and base course disturbed by trenching operations shall be replaced.

1.7.4 Lower Portion of Trench

Backfill material below and around pipe shall be deposited in 6 inch maximum thickness layers and compacted with suitable hand tampers to 90% of maximum density until there is a cover of not less than 1 ft. over the pipe. The backfill material in this portion of trench shall consist of sandy clay or other approved materials free from stones and lumps.

1.7.5 Remainder of Trench

The remainder of the trench portion above pipe shall be backfilled with material that is free from stones larger than 6 inch in any dimension. Backfill material shall be compacted to achieve a minimum relative density of 90% of modified proctor test at optimum moisture content for cohesive soils and 95 percent of maximum density for others.

1.8 BORROW

In case of insufficiency of excavated material and un-suitability of earth for backfilling, conforming to the above specifications, such material shall be brought from the source approved by the Engineer.

1.9 GRADING

After the completion of all backfilling operations, the Contractor shall grade the work areas to the lines, grades and elevations shown on the drawings or as directed by the Engineer. Finished grading shall not be done until the installation of all utilities or appurtenance. All damage due to settlement shall be repaired by and at the expense of the Contractor.

1.10 TESTING OF SOIL IN PLACE

The Engineer will make tests using the calibrated cone method/core cutter method to determine the density of soil in place. If soil in place fails to meet the specified degree of compaction the areas represented by the failing tests shall be removed, replaced and compacted to the specified density in the manner directed by the Engineer and at no additional cost to the Owner.

1.11 MEASUREMENT AND PAYMENT

1.11.1 Excavation and Backfilling

1.11.1.1 Method of Measurement

The measurement shall be made in cubic feet of earth acceptably excavated and backfilled for trenches and structures within the lines and grades shown on the drawing or as directed by the Engineer.

1.11.1.2 Basis of Payment

Payment for earth excavation and backfilling in trenches or structures will be made at the contract unit price per cubic ft.

The cost of dewatering, disposal of earth & earth & any shuttering or support required for excavation is included in the execution unit price.

Pay Item	D e s c r i p t i o n	Unit
1.1	Excavation for structures and compacted backfill including dewatering & disposal of surplus material.	Cft.
1.2	Excavation for trenches and compacted backfill including dewatering & disposal of surplus material.	Cft.

SECTION - 2

CONCRETE

2.1 SCOPE

This section covers the manufacture, forming, transporting, placing, stripping of forms, finishing and curing of plain and reinforced normal concrete in the structures included herein.

2.2 SPECIFICATIONS

Concrete work shall conform to all requirements of ACI 301-72, (Revised 1975), Specifications for Structural Concrete for Buildings, except as modified by supplemental requirements below. The Contractor shall submit, for the approval of the Engineer, before commencement of any work, his Method Statement which would provide complete details of the procedures and equipment to be used for the satisfactory execution of the work. The approval of such Method Statement shall not relieve the Contractor of any of his responsibilities under the Contract.

2.3 COMPOSITION AND QUALITY

Concrete shall be composed of Portland cement, water, fine and coarse aggregates and any admixtures as and when specified. The concrete mixes will be designed by the Engineer who will determine the required quality of the concrete for the structures covered by these Specifications. The desired strength of concrete for various parts of the structures have been shown on the Drawings. Such concrete mixes shall not relieve the Contractor of the responsibilities to the achieve the desired strength of concrete for various parts of structures as specified in the Technical Specifications or shown on the Drawing and to the full satisfaction of Engineer.

2.4 CEMENT

2.4.1 General

Cement shall be furnished in sacks or in bulk form as approved by the Engineer. Unless otherwise permitted, cement from not more than two plants shall be used and in general, the product from only one plant shall be used in any particular section of the work. No cement recovered through cleaning sacks shall be used.

2.4.2 Portland Cement

Portland cement shall be indigenous stuff unless otherwise approved by the Engineer. Portland cement shall conform to latest British Standard 12:1971, Specifications for Portland Cement or to ASTM Designation C150- 74, Standard Specifications for Portland Cement for Type I. Portland cement conforming to ASTM Designation C150-74, Type II or IV may also be used in certain parts of work as directed by the Engineer.

2.4.3 Tests

Cement shall be sampled at storage site and tested from time to time at the discretion of the Engineer in accordance with the ASTM Designation C150-74 or its equivalent British Standards. Expenses for such tests shall be borne by the Contractor. If the tests prove that the cement has become unsatisfactory, it shall be discarded and thrown as rejection as directed and to the full satisfaction of the Engineer. Cement which has been in storage at the project site longer than four months, shall not be used until retesting proves it to be satisfactory.

2.4.4 Storage

Cement shall be stored in dry, weather tight and properly ventilated structure. All storage facilities shall be subject to approval and shall be such as to permit easy access for inspection and identification of each consignment. Sufficient cement from a single source shall be in storage at the work site to complete any lift of concrete stored. Adequate storage capacity shall be furnished to provide sufficient cement to meet the peak needs of the project. Cement in sacks shall be stored on a damp proof floor and shall not be piled to a height exceeding 6 feet.

The Contractor shall use cement in the approximate chronological order in which it is received at the site. All empty sacks shall be promptly disposed of as permitted and directed by the Engineer so as to avoid any confusion in use of quantity of cement.

Cement storage facilities shall be emptied and cleaned by the Contractor when so directed, however the interval between required cleaning normally will not be less than four months.

Suitable, accurate scale shall be provided by the Contractor for weighing the cement in stores and elsewhere on the work, if required, and he shall also furnish all necessary test weights.

2.4.5 Delivery and Usage Record

Accurate records of receipts of cement at site and its use in the work shall be kept by the Contractor. Copies of these records shall be supplied to the Engineer in such a form as he may require.

2.5 AGGREGATES

Materials used as aggregates shall be obtained from sources known e.g Margalla/Shaheenabad/Sikhanwali to produce satisfactory results for the different classes of concrete. The use of aggregates from sources which have not been approved by the Engineer shall not be permitted.

2.5.1 Fine Aggregate for Concrete

Fine aggregate for all the classes of concrete shall be well graded natural sand, stone screenings or other inert material of similar characteristics or a combination of these. The whole of it shall be perfectly clean, free from coagulated lumps, soft and flaky particles, shale alkali, organic matter, loam mica and injurious amount of other deleterious substances. Maximum allowable content of silt and other deleterious inert substances is 5 percent by washing. Material derived from stone unsuitable for coarse aggregate shall not be used as fine aggregate. Fine aggregate derived from stone screenings shall be sharp, cubical, hard, dense and durable and shall be stacked on a platform so as to adequately protect it from dust and other admixtures.

Grading for the above specified fine aggregate shall be within the following limits, as determined by the Owner:

Sieve Size	**Percentage Passing (Dry Weight)**
3/8 inches	100
No. 4	95 to 100
No. 8	80 to 90
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

Fine aggregate for class D (1000 psi) concrete may be good quality bank run sand obtained from the River in vicinity. It shall be clean natural material graded from fine to coarse, free from lumps, clay, cinder, ashes, rubbish and other debris. It shall not contain more than 5 percent of material finer than No. 200 mesh screen, not more than 5 percent remaining on No. 4 sieve; all material shall pass through 3/8" screen.

2.5.2 Coarse Aggregate for Concrete

Coarse aggregate for the first 3 classes of concrete shall consist of quarried or crushed stone/river run gravel or inert material or a combination of these, with maximum size of 3/4 inch and shall be clean, hard durable, sound, cubical and well shaped, free from soft or friable matter, or thin elongated pieces, alkali, organic matter or injurious amounts of other deleterious substances. Deleterious inert matter shall not exceed 3 percent.

Grading for above specified coarse aggregate shall be within the following limits:

Sieve Size	**Percentage Passing (Dry Weight)**
1 inch	100
3/4inch	90 to 100
1/2 inch	20 to 55
3/8 inch	0 to 10
#-4	0 to 5

Coarse aggregates for Class D (1000 psi) concrete shall be broken stone or river run gravel from dense hard stone, or boulders. The stone or gravel should not be porous or slaty it must be free from earth, sand or other foreign matters. The broken aggregate or gravel shall be of the prescribed size for the class D (1000 psi). The broken aggregate or gravel shall be of max. size 1 inch or 1 1/2 inches and not contain any thing which will pass through No.4 sieve.

2.5.3 Storage of Aggregate

Each class of aggregate is to be stored separately and the Contractor is to provide means of ensuring that aggregates are stored on a suitable hard clean surface or platform to prevent contamination from the ground.

2.5.4 Proportions of Coarse and Fine Aggregates

The nominal ratio of the Volume of coarse aggregate to the volume of fine aggregate shall be decided by compression test of concrete cubes or cylinders to be furnished by the Contractor but the Owner may order these ratios to be varied slightly according to the grading of the aggregates by weight, if necessary, so as to produce required grading. Engineer can get the tests carried out at Contractor's cost.

At the beginning of the work and where there is any change in the coarse or fine aggregates or in their source of supply, the Contractor is to have a series of tests on cubes/cylinders made representative of and marked as to the aggregates and their grading and mix of concrete. Such cubes are to be tested in the laboratory under identical conditions, except for small variations in the relative

proportions of the coarse and fine aggregates up and down from the best proportions derived from the sieve analysis. The cubes etc. are to be tested at 7 days.

2.5.5 Water

Water for washing aggregates and for mixing and curing concrete shall be clean and free from injurious amounts of oil, acid, alkali, salt, organic matter, or other deleterious substances as determined by standard tests selected by the Engineer. It shall meet the following chemical requirements:

Chlorides such as sodium chloride	Max 3000ppm
Sulphates such as sodium sulphate	Max 2000ppm
Impurities	Max 2000ppm
Metled Salt	Max 25000ppm

The water for curing concrete should not have pH value lower than 5 and shall not contain impurities which cause discoloration of concrete.

2.6 CONCRETE MIX REQUIREMENTS

2.6.1 Strength

The concrete shall be one of four different classes to be paid for at their respective unit prices designated. The numerical classifications refer to the approximate proportions of cement, fine aggregate and coarse aggregate, according to the common practice. However, the actual concrete mix requirement shall consist of proportioning and mixing for the following strengths when tested in the form 6" cubes, 3 for 7 days and 3 for 28 days test shall be made for each class of concrete. The cubes are to be made, cured, stored, transported and tests are to be carried out at a testing laboratory approved by the Engineer. All such tests shall be at the cost of the Contractor.

Concrete Class	Cylinder (Min) Compressive Strength		Cube (Min) Compressive Strength	Tentative Ratio
	Tested at 7 days	Tested at 28 days	Tested at 28 days	
A:	2000 psi	3000 psi	4000 psi	1:1-1/2:3
B:	1600 psi	2400 psi	3000 psi	1:2:4
C:	1000 psi	1600 psi	2000 psi	1:3:6
D:	No strength requirements	800 psi	1000 psi	1:4:8

2.7 WATER CEMENT RATIO

The water-cement ratio is the ratio of the weight of water in the mix to the weight of cement therein. Water content shall be sufficient to produce a workable mix of the specified strength but the total water content shall be governed by the following table:

Concrete Class	Maximum Permissible Total Water Demand (Imperial) Gallons per 112 pounds of cement
A:	6.0
B:	7.5
C:	8.0
D:	No requirements

2.7.1 Consistency

Proportions of ingredients shall vary to achieve the desired concrete consistencies when tested, conforming to the following slump requirements or as desired by the Engineer:

Use of Concrete	Minimum and Maximum Slump (inch)
Normally reinforced sections compacted by vibration, hand compacted mass concrete.	1 to 3
Heavily reinforced concrete sections compacted by vibration, hand compacted concrete in normally rein-forced slabs, beams, columns and walls.	2 to 4

In all cases, the proportions of aggregates for concrete shall be such as to produce mixes which will work readily into the corners and angles of the forms and around the reinforcement without permitting the segregation of materials or liateance. Uniformity in concrete consisting from batch to batch shall be ensured.

2.8 MEASUREMENT OF MATERIALS

The coarse and fine aggregate are to be weighed or accurately measured to the Engineer's satisfaction. In no event they are to be measured by the shovel or barrow.

2.9 MIXING METHODS

The concrete shall be mixed in an approved mechanically operated batch mixer. The mixer, its hopper and working platforms shall be protected from rain and wind.

The aggregates and cement shall be mixed together before adding water until the concrete is of even colour and consistency throughout. Dirt and other undesirable substances shall be excluded. Water shall not be added indiscriminately from a hose or can. All concrete shall be thoroughly mixed by a modern reliable batch mixer to produce maximum output of concrete necessary to complete the work within the specified time without reducing the required mixing time. Concrete shall be mixed in the concrete mixers for the duration required for uniform distribution of the ingredients to produce a homogeneous mass of consistent colour but for not less than 1 1/2 minutes. The mixer shall be operated by trained operators, who have previous experience of running and operation of concrete mixers.

At the conclusion of mixing, the mixer and all handling plants shall be thoroughly cleaned out before the concrete remaining in them has had time to set.

No concrete shall be mixed by hand without the Engineer's written consent, and such consent shall be given only for small quantities under special circumstances.

2.10 TEST OF CONCRETE

2.10.1 Strength Test During the Work

Strength tests of the concrete placed during the course of the work will be made by the Engineer in an approved laboratory at the Contractor's expenses. The Contractor shall assist the Engineer in obtaining, for control purposes, such number of cylinders or cubes as the Engineer may direct, but in general, three beams taken from each 2650 cu.ft.or fraction thereof, or from each days pour, whichever is less, of each class of concrete placed, shall govern. Test specimen will be made and cured by the Engineer in accordance with the applicable requirement of ASTM Designation C31-69, Standard Method of Making and Curing Concrete Compressive and Flexural Test Specimens in the Field.

Cubes and beams will be tested by the Engineer in accordance with the applicable requirements of ASTM Designation C39-72, Standard Method of Test for Compressive Strength of Cubical Concrete Specimens and ASTM Designation C78-64, Standard Method of Test for Flexural Strength of concrete (Using Simple Beam with Third Point Loading). The test result will be based on the average of the strength of the test specimens except that if one specimen in a set of three shows manifest evidence of improper sampling, moulding, or testing, the test result will be based on the average of the remaining two specimens. If two specimens out of a set of three show such defects, the results of the set will be discarded and average strength determined from test results of the other two sets. The standard age of test will be 28 days, but 7 day tests may be used at the discretion of the Engineer, based on the relation between the 7 days and 28 days strengths of the concrete as established by tests for the materials and proportions used. If the average of the strength test of three specimen cured under laboratory controls, for any portion of the work, falls below the minimum allowable compressive or flexural strength at 28 days required for the class of concrete used in that portion, the Engineer may change the proportions of the constituents of the concrete, as necessary to secure the required strength for the remaining portions of the work. If the average strength of the specimens cured under actual field conditions as specified herein before falls below the minimum allowable strength, the Engineer will make such changes in the conditions for temperature and moisture under which the concrete work is being placed and cured as may be necessary to secure the required strength.

2.11 CONVEYING OF CONCRETE

Concrete shall be conveyed from mixer to the place of final deposit as rapidly as practicable, by methods which will prevent segregation or loss of ingredients and in accordance with latest edition of ACI Code Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

Any wet batch hopper through which the concrete passes shall be conical in shape. There shall be no vertical drop greater than 5 ft. except where suitable equipment is provided to prevent segregation and where specifically authorized. Belt conveyers, chutes, or other similar equipment will not be permitted either for conveying concrete except where the use of such equipment is approved in writing by the Engineer, in advance of any use. Each type or class of concrete shall be visually identified by placing a coloured tag or marker on the bucket as it leaves the mixing plant so that the concrete may be positively identified and placed in the structure forms in the desired position.

2.12 PLACING

2.12.1 General

Concrete placing shall follow the Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete, latest ACI Code requirement. No

concrete shall be placed until all formwork, reinforcement, installation of parts to be embedded, bracing of forms and preparation of surface involved in the placing and the method of placement have been approved by the Engineer. Approval of the method of placement proposed will not relieve the Contractor of his responsibility for its adequacy and he shall remain solely responsible for the satisfactory construction of all work under the Contract.

Before concrete is placed, all surfaces upon or against which concrete is to be placed shall be free from standing water, mud, debris or loose material. All surfaces of form and embedded material that have become encrusted with dried mortar or grout from concrete previously placed shall be cleaned of all such mortar or grout before the surrounding or adjacent concrete is placed. The surfaces of absorptive material against or upon which concrete is to be placed shall be moistened thoroughly so that the moisture will not be drawn from the freshly placed concrete. Concrete shall be worked into the corners and angles of the forms and around all reinforcement and embedded items without permitting the materials to its final position in the forms. The depositing of concrete shall be regulated so that the concrete may be effectively compacted with a minimum of lateral movement into horizontal layers approximately 1.5 ft. in thickness. No concrete that has partially been hardened or contaminated by foreign materials shall be deposited in the structure, nor shall retampered concrete be used unless approved by the Engineer. The surfaces of construction joints shall be kept continuously wet for at least eighteen hours during the twenty four hours period prior to placing concrete except as otherwise directed by the Engineer. All free water shall be removed and the construction joint shall be completely surface dry prior to approval All concrete placing equipment and methods shall be subject to approval. Concrete placement will not be permitted, when in the opinion of the Engineer weather conditions prevent proper placement and consolidation.

2.13 COMPACTING CONCRETE

All concrete, except that in blinding layers and in- situ-concrete in very small sections, shall be compacted by vibration. After any necessary hand spading, working and ramming into place, each layer of concrete shall be compacted with mechanical immersion vibrators of types approved by the Engineer.

The immersion vibrators shall produce a vibration frequency of not less than 6000 impulses per minute. Under no circumstances shall the immersion vibrators be allowed to come into contact with reinforcement or shuttering. Immersion vibrators shall penetrate vertically for a few inches into any previous unset layer in order to establish a satisfactory bond, but no concrete shall be vibrated in such a manner as to cause injury to concrete (already set or otherwise) in other parts of works. Care shall be taken to keep the vibrators vertical, to insert them at regular intervals and withdraw them slowly to prevent the formation of voids, so that the entire mass of the concrete is properly compacted. Haphazard or random penetration of the vibrators without sufficient depth of insertion shall be avoided. A sufficient number of vibrators shall be

used to ensure compaction of each batch of concrete before the next batch is delivered. At least one extra vibrator shall be in hand for emergency use.

Vibration shall be supplemented by hand punning with approved small-diameter smooth steel rods with rounded ends in order to achieve complete compaction around reinforcement and other embedded fittings and a completely dense mortar finish against the shuttering.

Excessive vibration shall be avoided and vibration shall not be continued after a good surface finish, without free water, has been achieved. Vibration and punning shall be just sufficient to produce a dense, homogeneous concrete properly filling the moulds and free from air voids, segregation, bleeding, honey combing and other imperfections. Only highly skilled operators and workmen, subject to constant supervision, shall be employed in vibrating and punning concrete.

2.13.1 Time Interval between Mixing and Placing

Concrete mixed in stationary mixers and transported by non-agitating equipment shall be placed within thirty minutes after it has been mixed, unless otherwise authorized. When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within 1 1/2 hours after introduction of the cement to the aggregates. The concrete shall be placed within 20 minutes after it has been discharged. In all cases, concrete shall be placed and compacted well within the initial setting time.

2.14 CONCRETE FINISHES

Concrete fishes shall be made in accordance with the provision of ACI 301-8 or as directed by the Engineer

Workmanship in shuttering and concreting shall be such that concrete work shall normally require retouching and the surfaces being dense, watertight and where steel shuttering has been used, perfect and smooth. Should there be faults in these respects, the Contractor shall cut out and replace the whole of the lift concerned or such amount as the Engineer decides, or make good if permitted by the Engineer and to his approval. Concrete which is honey-combed or otherwise shows voids shall invariably be cut out and replaced in an approved manner as suggested by the Engineer.

Any making good shall be carried out immediately after striking the shuttering and shall be restricted to light rubbing down with wet carborundum or the approved correction of minor blemishes. In no circumstances shall surfaces be made good with cement or washes or rendering.

Exposed concrete surfacing not requiring shuttering and not subsequently to be given extra finishes shall be given perfectly dense smooth finish with a wooden float.

Where concrete slabs, ducts, bases or machine plinths will themselves form the finished floor surface the concrete shall be troweled immediately after the first laying process only just sufficiently to give a level surface. Thereafter, when the concrete has stiffened to a condition such that a hard compacted surface can be obtained without bringing up llaitance, a final surface troweling shall be given with a steel float to produce a smooth finish.

2.15 CONCRETE AND WEATHER

No concrete shall be placed when the atmospheric temperature is below 15 degree centigrade without the written permission of the Engineer. When directed by the Engineer the Contractor shall provide adequate means for maintaining a temperature of not less than 20 degree centigrade for 3 days or 15 degree centigrade for five days after placing the concrete.

If Rapid-Hardening Portland Cement is used, the period may be reduced as directed by the Engineer.

The Contractor shall supply such heating apparatus as stoves salamanders or steam equipment and the necessary fuel. When dry heat is used, means of maintaining atmospheric moisture shall be provided. All aggregates and mixing water shall be heated to temperature of at least 20 degree centigrade, but not more than 75 degree centigrade, the aggregates may be heated by either steam or dry heat, if permitted by the Engineer the torch method of heating mixed aggregate shall be such as to heat the mass uniformly and avoid spots which will burn the materials. The temperature of the concrete shall be not less than 10 degree centigrade at time of placing in the forms.

In case of extremely low temperature, the Engineer may, at his discretion, raise the minimum limiting temperature of water, aggregates and mixed concrete. When the shade temperature is above 32 degree centigrade, special precautions shall be observed during concreting to the satisfaction of the Engineer. Concreting will be permitted when it is not raining. Thermometer shall be kept at the Site by the Contractor.

2.16 CURING OF CONCRETE

Unless otherwise specified or ordered by the Engineer all concrete shall be cured by water. It shall be kept wet continuously for at least fourteen days after placement. It shall be covered with water saturated material like gunny bags, canvas, clean sand, matting, etc. or any other improved method duly approved by the Engineer.

In order that tensile stresses on the cooling of concrete shall be kept to a minimum, all materials shall be as cool as practicable when mixed and placed. To this end, aggregates shall be covered, coarse aggregates shall be cooled with water and mixing plant etc., water storage tanks and pipelines shall be covered or insulated from the effects of the sun. The temperature of concrete on placing shall in no case exceed 32 degree Centigrade.

Concrete shall be placed only against surfaces which are damp and no such work shall be started until arrangements for keeping the shuttering continuously cool and wet are in place. Shuttering and exposed faces of concrete and mortar shall be covered by at least 3 thicknesses of approved stout hessian kept continuously cool and wet by an efficient and comprehensive system of sprinklers and diffused jets of water, with appropriate temporary drainage arrangements, for at least 14 days after placing.

As an alternative to continuous curing with water after stripping of shuttering a proprietary membranes method of curing may be used provided that it is used strictly in accordance with the manufacturer's instructions, is coloured to show its presence, contains no bituminous substance, does not prejudice the appearance of permanently exposed concrete surfaces and is in all other respects to the approval of the Engineer. Wherever practicable, both faces of concrete structures shall be appropriately treated in order to prevent tensile stresses due to differential shrinkage or temperature across the section. Further more, the Contractor shall continue to provide facilities for covering and/or keeping wet such exposed surfaces of the Work as are, in the opinion of the Engineer liable at any time to be damaged by weather.

At no time shall any further work involving concrete proceed until the Contractor has satisfied the Engineer that all such work previously carried out is being protected and cured in accordance with this clause.

2.17 CONCRETE IN EXCAVATION AND FILLING

Before concrete is placed in or against any excavation or filling, the surface of such earthwork shall have been compacted and shall be free from running and standing water, oil and other deleterious matter. Loose earth and other material shall be removed. The excavation or filling shall be damp but not wet and special precautions shall be taken to prevent groundwater from damaging unset concrete or causing movement of the concrete.

Immediately after the excavation or filling has been trimmed and prepared as above, the exposed foundation shall be protected by a blinding layer or "No-fines" concrete or of cement mortar or other protection as shown on the Drawings or ordered by the Engineer. Such blinding layers and coatings shall be thoroughly cleaned and moistened before further concrete work is placed thereon.

Reinforced concrete shall not be cast against an unprotected face of earth or any other material liable to become loose or to slip; the greatest possible care shall be taken to avoid falls of material on to the concrete, by leaving the timbering in place (if permitted) or by removing the timbering in small depths and lengths at a time and by any other approved means. If any such falls occur, all soiled concrete shall be removed and replaced at Contractor's own cost.

2.18 SHUTTERING

The Contractor shall submit, for the approval of the Engineer full proposals and design calculations for all shuttering and proposals for the period of time to elapse before each item of the shuttering is struck. Not withstanding the approval of the Engineer to any actual shuttering or proposals for its striking, the Contractor shall retain complete responsibility for its adequacy as to the provisions of this clause and for any consequences of the striking being premature or harmful. In general the minimum time for the removal of form work shall be as under:

Form Work		Removal Time	Normal Weather above 15°C
a)	Form work of vertical surfaces such as Beams side walls and columns	4 days	2 days
b)	Slabs, props left under	10 days	5 days
c)	Props to slab	14 days	10 days
d)	Beam soffits, prop left under	14 days	7 days
c)	Removal of props to Beams	21 days	21 days

Shuttering shall be designed with easily sealed access hatches for inspection purposes and for removal of water and deleterious materials, and with connections to facilitate striking without damaging the concrete. Shuttering for soffits of slabs shall be erected with an upward camber of 1/4" for each 10 feet of span. When props are to be left in position under slabs the shuttering shall be made and removed in such a way that the props are not disturbed in any way.

A tolerance of plus or minus 1/8 inch in line or level will normally be permitted after erection of the shuttering which shall nevertheless be sufficiently strong, stiff and rigidly braced against loads due to the wet concrete and vibration and

against constructional loads, to remain true to the line and level accepted before concreting. It shall be sufficiently watertight to ensure that there shall occur no "fine" or escape of mortar at joints or of liquid from the concrete.

All exterior angles for concrete work not permanently burried in the ground shall be given 3/4" x 3/4" chamfers unless otherwise indicated on the Drawings.

Timber for shuttering shall be well seasoned, free from loose knots, splits, projecting nails and the like and from any adhering foreign matter.

Steel shuttering shall be used to produce a fair face concrete with only a faint but consistent pattern of plate marks on exposed concrete surfaces. The shuttering shall be assembled from wrought tongued and grooved boarding, true and tightly fitted with joints as necessary, the whole surface and all edges being rendered smooth before and after oiling. Bearing in mind the quality of the finish required, wrought, plain-edged and butt-joint boarding may replace the tongued and grooved boarding or purpose-made steel- faced shutters of first-class quality may be used, solely at the discretion of the Engineer.

Rough shuttering shall be used for surfaces to be buried in the ground and shall be assembled from sawn boards with smooth and true edges or from approved steel shutters. In either case all joints shall be suitably filled.

The inside faces of all shuttering shall be treated with an approved material to prevent adhesion of the concrete, all such materials being kept clear of the reinforcement and other items to be embedded.

Shuttering shall be struck by static force alone without shock and vibration causing any damage to the concrete. Shuttering being reused shall be thoroughly repaired and cleaned before re-assembly.

2.19 WATER STOPPER'S

2.19.1 Scope

The work to be done under this item consists of providing and installing PVC/Metal water stops as shown on the Drawings or as directed by the Engineer.

2.19.1 (a) Polyvinylchloride Water Stopper

Polivinylchloride waterstops shall be extruded from an elastomeric plastic compound, the basic resin of which shall be polyvinylechloride (PVC) The compound shall contain such additional resins, plasticizers, stabilizers or other materials needed to ensure that when the material is compounded and extruded to the shapes and dimensions shown, it will have physical characteristics when tested by the U.S. Corps of Engineers Tested Method specified below:

Physical Characteristics	No of Specimens Tested	Requirement	USCE Test Method
Tensile strength using die III, not less than	5	1750 psi	568
Ultimate elongation using die III, not less than	5	350%	573
Low temperature brittleness, no sign of failure such as cracking or chipping at	5	-35°F	570
Stiffness in flexure, 1/2 inch span, not less than	3	400 psi	571

Installation

The PVC Water stops shall be laid in continuous lengths. Splices in the continuity or at the intersections of runs of PVC water stops shall be performed by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations or as directed by the Engineer. A thermostatically controlled electric source of heat shall be used to make all splices. The correct temperature at which splices should be made will differ with the material used but should be sufficient to melt but not char the plastic. After splicing, a remolding iron with ribs and corrugations to match the pattern of the waterstop shall be used to reform the ribs at the splice. The continuity of the characteristic components of the cross section of the waterstop design (ribs, tubular center axis, protrusions, and the like) shall be maintained across the splice.

2.19.1 (b) Metal Waterstops

Copper, stainless steel and steel waterstops shall be installed in joints at the locations shown on the Drawings. The thickness, shape, dimensions and splicing of metal waterstops shall be as shown on the Drawings or as approved by the Engineer.

2.20 TERRAZZO WORK

2.20.1 Scope

The work to be done under this item consists of providing terrazzo finish inside the water tanks and at any other place shown on the Drawings. The subgrade shall comprise of (i) cement plaster (ii) cement concrete.

2.20.2 Material

Marble Chips of the specified grade, and colour shall be of approved quality obtained from quarries in Pakistan. Before any material is purchased, the Contractor shall submit to the Engineer for approved samples in duplicate. The material used in the work shall correspond with the approved samples, in quality, colour texture and finishes etc.

2.20.3 Subgrade

The subgrade under terrazzo top shall be 3000 psi cement concrete or1:2 cement sand plaster of the thickness specified on the Drawings. The subgrade shall be constructed in accordance with the applicable stipulations and requirements, Cement Plaster of the Specifications. The subgrade surface shall be kept wet for proper adhesion of terrazzo topping, which shall be laid when the subgrade has still not hardened.

2.20.4 Topping

Terrazzo top finishing of thickness as shown on the Drawings or the Finishing Schedule shall consist of marble chips and cement mixed in ratio of 1:2 (one part grey cement and 2 parts chips of approved grading and shade with admixture of approved pigment). Terrazzo topping shall be laid true to the pattern as given on the Drawings or as directed by the Engineer. The terrazzo topping shall be well compacted and all voids and dips made good.

2.20.5 Final Finish

Smooth Finish: After 48 hours of laying the terrazzo topping requiring smooth finishes shall be grinned with No.80 Carborundum stone until the marble chips are evenly exposed.

After the first grinding neat coat of suitably coloured cement slurry be applied to repair the pores if any, formed during the course of grinding and cured for 24 hours. The second and the third grinding shall be suitably carried out with grinding stone ranging from No. 80 to 240 respectively. Electric grinders shall be used to ensure that the grinding is adequate.

The surface after all chips have been evenly exposed will be cured for one week and left undisturbed for another week. After this period the surface shall be cleaned of dirt and dust by rubbing gently with pumice stone with sufficient water. If this treatment is not successful in removal of the white scum or other materials and hardened deposits, the floor shall be lightly rubbed with grinding stone while washing soda solution is being used. it would then be treated with oxalic acid (1:10) solution using felt or an old blanket. After oxalic acid treatment the surface shall be cleaned and washed with plenty of water and dried.

2.21 STEEL REINFORCEMENT

2.21.1 Scope

The work to be done under these items shall include furnish, cut, bend, and place all steel reinforcement as indicated on the Drawings or otherwise required. All reinforcement when surrounding concrete is placed shall be free from loose, flaky rust, and scale, and free from oil grease or other coating which might destroy or reduce its bond with the concrete. All placing shall be in accordance with Drawings furnished or approved. The use of reinforcement for the transmission of current for welding will not be permitted. All reinforcement, including dowels, remaining exposed in the work shall be suitably protected until embedded in concrete.

2.21.2 Cutting and Bending

Steel reinforcement may be mill or field cut and bent. All bending shall be in accordance with standard approved practice and by approved machine methods. When bending is required, it shall be performed prior to embedding the bars in the concrete. In all such cases, the bars shall be cold bent. Bending or straightening of bars partially embedded in set concrete shall not be permitted except in isolated cases where corrective action or a field change is required and is specifically approved by the Engineer.

2.21.3 Quality

Concrete reinforcement bars shall be of following quality:

Intermediate grade Steel: It shall be deformed bars conforming to ASTM 615-81(a,b) grade 40/ grade 60 or equivalent having a minimum yield strength of 40,000 psi/ 60,000 psi. The Contractor shall provide labour, materials, arrange measuring and testing facilities to ascertain quality, weight or quantity of steel at his own expense, No steel shall be incorporated in the Works without prior approval of the Engineer.

2.21.4 Spacing of Bars

The spacing of bars shall be as shown on the Drawings or as directed by the

Engineer. The variation from indicated spacing, provided that the total area of reinforcement is in accordance with the Drawings, shall not be more than 1 inch.

2.21.5 Relation of Bars to Concrete Surface

The cover of all main reinforcement shall conform to the dimensions shown on the Drawings. The protective covering shall not be less than, and shall not exceed more than 1/4" from the values specified on the Drawings, indicate the clear distance from the edge of the main reinforcement to the concrete surface. The concrete covering of stirrups spacer bars, and similar secondary reinforcement may be reduced by the diameter of such bars.

2.21.6 Splicing

Except as otherwise shown on the Drawings or specified herein, all splices, lengths of laps, splice locations, placement and embedment of reinforcement shall conform to the applicable requirements of American Concrete Institute 318-77, Building Code Requirements for Reinforced Concrete. All splices and locations of laps in reinforcement shall be as shown on the Drawings or as directed by the Engineer. Additional bar splices shall be provided as required, subject to approval of the Engineer. Lapped ends of bars may be placed in contact and securely wired or may be separated sufficiently to permit the embedment of the entire surface of each bars by butt-welding or by approved mechanical methods such as the Cadweld splice or other type splice using positive connectors shall be adopted where indicated or directed by the Engineer. Butt welding of reinforcing bars, where indicated or directed shall conform to the requirements of American Welding Society's Recommended Practice for Welding Reinforcing Steel, Metal Inserts and Connections, D.12.1. Concrete shall be protected from heat during welding operations.

2.21.7 Supports

All reinforcement shall be secured in place by use of metal or concrete supports, spacers, or ties, as approved by the Engineer. Such supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation. The supports shall be used in such a manner that they will discoloration or deterioration of the concrete. Concrete supports shall be manufactured of the same concrete mix as used in the structure to be concreted.

2.22 MEASUREMENT AND PAYMENT

Measurement and payment for concrete, reinforcement, precast concrete, PVC water stop and Terazzo/Mosaic work will be made in accordance with the provisions of this clause specified hereinafter.

2.22.1 Method of Measurement

Concrete will be measured for the number of cubic feet acceptably placed complete in all respects as per Drawings and in strict accordance with this section of specification.

Measurement for steel reinforcement will be made of number of Tons of reinforcing steel acceptably placed on the basis of the lengths of bars installed in accordance with the approved Drawings or bar schedules or as directed, converted to weight for the size of bars listed by the use of unit weights per linear foot as follows:

Bar Size	Unit Weight lbs. per foot
1/4"	0.167
3/8"	0.376
1/2"	0.668
5/8"	1.043
3/4"	1.502
7/8"	2.044
1"	2.670
1 1/8"	3.775
1 1/4"	4.172
1 3/8"	5.049

Steel in laps and embedments indicated on the Drawings or as required by the Engineer will be paid for at the steel unit price. No measurement for payment will be made for the steel consumed in providing supports and for the additional steel in laps which are authorised for the convenience of the Contractor.

Polyvinylechloride water stop of the size and gauge as shown on the Drawings will be measured for the number of linear feet acceptably placed in the work. In computing the quantities, no allowance will be made for laps.

Measurement for terrazzo/mosaic work will be made in square feet as shown on the Drawings.

2.22.2 Basis of Payment

Payment will be made in accordance with the unit prices in the Bill of Quantities for the various items in accordance with the specifications and shall constitute full compensation for furnishing all materials, shuttering, equipment and labour and for performing all operation necessary to complete the work.

BOQ Item	D e s c r i p t i o n	Unit
2.1	Provide and lay concrete	Cft.
2.2	Furnish and Fix Reinforcing Steel	Tons
2.3	Furnish and Install Water Stop	
	(i) PVC	Lft.
	(ii) Stainless Steel	Lft.
2.4	Provide and Lay Terrazzo/Mosaic Work	Sft.

SECTION - 3

BRICK AND CEMENT CONCRETE BLOCK WORK

3.1 SCOPE

This section consists of construction of brick/ cement concrete block work walls of any thickness with first class hand-mould and/or machine pressed bricks/cement concrete blocks with the specified ratio of cement mortar in foundation, plinth superstructure or for any other structure as directed by the Engineer, or shown in the Bid Schedule. The Contractor shall furnish all materials and all other requirements to produce finished brick/block work. Brick/block work and materials for brick/block work shall be in strict accordance with this section of the specifications and applicable drawings and subject to the terms and conditions of the Contract.

3.2 MATERIALS

3.2.1 Portland Cement

Portland cement shall conform to the stipulations and requirements set forth in Section "CONCRETE".

3.2.2 Mortar Sand

Sand for mortar used in construction of brickwork/blockwork required under these Specifications shall be furnished by the Contractor in accordance with the provisions and in conformity with the stipulations and requirements of ASTM Designation C144-70 or latest revision and shall have a fineness modulus between 1.6 to 2.5.

3.2.3 Water

The water used in the preparation of mortar shall be free from objectionable quantities of silt, organic matter, alkali salts and other impurities and it will be tested in accordance with BS-3148 and approved by the Engineer at the Contractor's cost.

3.2.4 Aggregate

Aggregates for mortar shall comply with the requirements of ASTM C144. Sand that has been in contact with seawater shall not be used unless it has been thoroughly washed to the satisfaction of the Engineer.

3.2.5 Additives

Additives where used, shall be proprietary products used in the proportions and manner recommended by the manufacturer. The additives shall in no way adversely affect the mortar strength or contain chemicals, which may e harmful to other building materials. To add gypsum to cement is strictly forbidden.

3.3 MORTAR AND GROUT

Materials for mortar, sand binding agent and water shall be mixed by volume for at least 3 minutes with the minimum amount of water to produce a correctly mixed mortar or grout of workable consistency in a mechanical batch mixer. For small jobs, hand mixing may be permitted, the ingredients being mixed with sufficient water to produce a correctly mixed workable mortar. Mortar used in masonry construction shall conform to ASTM C-270 standard.

Mortars shall be mixed in batches, which can be used within a period before the setting process commences. Once a mix begins drying off, it shall be rejected. No ingredients shall be added to it once the setting process has begun. Mortar shall not be retained for more than 30 minutes and shall be constantly worked over with hoe or shovel until used.

3.4 MORTAR BATCHING

Methods or equipment used for mixing mortar shall be such as will accurately determine and control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Engineer. If a mixer is used it shall be of approved design and the mixing time after the ingredients are in the mixer, except for the full amount of water, shall not be less than two minutes.

Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within 30 minutes after addition of water to the mix shall be wasted. Retampering of mortar shall not be allowed. Mixing pans and troughs shall be thoroughly cleaned and washed at the end of each day's work.

3.5 SCAFFOLDING

Contractor shall provide safe scaffolding of adequate strength for use of workmen at all levels and heights at his own expense. Scaffolding which is unsafe in the opinion of the Engineer shall not be used until it has strengthened and made safe for use of workmen. Cost of scaffolding etc., shall be included by the Contractor in the unit rate for masonry items.

Damage to masonry from scaffolding or from any other object shall be repaired by the Contractor at his own cost.

3.6. JOINTING

Jointing is the forming of joints as work proceeds. Joints shall be as follows:

3.6.1 Exterior exposed joints shall be tightly formed to a weather joint with the point of the trowel.

3.6.2 Interior exposed joints shall be tightly formed to a concave joints.

3.6.3 Joints which are subsequently covered with plaster or other finish materials shall be struck flush.

3.7 BRICKS

The bricks used shall be of standard size (9"x4.5"x3") first class well burnt, uniform in shape, size, texture, colour and should produce a ringing sound when struck. The bricks shall be free from flaws, cracks, chips, stone nodules of lime or kan-kar or any other blemishes. The brick shall not absorb more than one sixth of its weight when soaked in water for one hour. Compressive strength shall not be less than of 1400 psi. Bricks over burnt, under burnt vitrified and irregular shall not be used. Bricks of uniform size shall be used throughout the work and source of supply shall not be diversified.

3.7.1 Soaking

Before use all bricks shall be soaked in clean water in tanks or pits for at-least two hours.

3.7.2 Laying of Bricks

All brickwork shall be skillfully laid with level courses, uniform joints, square corners, plumb verticals and true surfaces except when otherwise shown on the Drawings or directed by the Engineer. Brickwork will be of best standard of workmanship obtainable and objectionable offsets in the brickwork shall be avoided. Smoothest practicable finished surface of the brickwork shall be ensured. Unless otherwise specified bricks shall be laid in English Bond with frogs (Manufacturer's marks) upward.

All horizontal joints shall be parallel and truly level. Vertical joints in alternate coarses shall come directly over one another. Thickness of joints unless otherwise specified shall not be less than 1/4 of an inch and not more than 3/8 of an inch. The height of 4 coarses and 3 joints as laid shall not exceed by more than 1 inch the height of 4 bricks as piled one upon the other.

3.7.3 Curing

All brick work involving use of cement shall be cured by water curing or other acceptable methods. The Engineer shall approve all methods and operations of the Contractor in curing different portions of work.

When curing by water brickwork shall be kept wet for at least 14 days by covering with water saturated materials or by a system of perforated pipes, mechanical sprinklers, porous hose, ponding or by any other approved method which will keep all surfaces to be cured continuously wet. Water used for curing shall meet the requirements given in Clause 3.2 of these specifications.

3.8 BLOCKS

Cement, aggregates and water for concrete blocks shall conform to the requirements as specified in the section for plain and reinforced concrete or as approved by the Engineer.

3.8.1 Concrete Block Making

3.8.1.1 The solid and hollow blocks as and where used by planning, shall be machine moulded. The block making machines shall be of the standard approved by the Engineer. They shall be operated according to the instructions laid down by the manufactures.

3.8.1.2 The blocks shall be continuously water cured by sprinkling water for a minimum of 10 days and covered between sprinkling operations with 4 mils thick polyethylene sheeting. After the 10 days water curing period the blocks shall be air dried. Under no circumstances will blocks be used in the work until they are completely dry. During curing period no surfaces of the block will be allowed to dry.

3.8.1.3 Cured concrete blocks shall be stored off the ground, stacked on level platforms, which allow air circulation under stacked units. Units shall be covered and protected against wetting.

3.8.1.4 Care shall be exercised in the handling of all concrete blocks. No damaged blocks shall be used in the work.

3.8.1.5 The blocks cast on different dates shall be stacked separately and must be labeled showing the date on which they were cast.

3.8.2 Properties of Blocks

3.8.2.1 All blocks shall be of size and shape required to complete the work shown in the Drawings or as instructed by the Engineer.

3.8.2.2 The cement, sand and coarse aggregate shall be volume batched and their proportion may be adjusted so as to provide the concrete of the required strength when tested and shall be mixed in a concrete mixer.

3.8.2.3 All blocks shall conform to ASTM C 145 standard. The compressive strength based on gross area shall be minimum 8.30 MPa for an average of 3 blocks and minimum 7.0 MPa for lowest individual blocks with 28 days after casting Cement Concrete Solid Blocks.

3.8.2.4 The Contractor shall provide test certificates show in the average minimum crushing strength of the blocks prior to the commencement of the construction. Further test certificates shall be provided as required by the Engineer, to ensure that all batches of block strengths are to be determined in accordance with ASTM C- 140 Standard.

3.8.2.5 The test shall be carried out by a laboratory approved by the Engineer. Evidence shall be produced that the block manufacturer has an efficient method of quality control. The Engineer will require to test samples of blocks periodically and the Contractor shall make necessary arrangements accordingly. The method of sampling for all test shall be in accordance with ASTM C-140.

3.8.2.6 All properties or specifications of blocks, not explain in these Specifications or ASTM C 145 shall comply with the requirements of PS 419, as directed by the Engineer.

3.8.3 Soluble Salt Content

For exposed block work, the contents by weight percent of soluble sulphate, calcium, magnesium, potassium and sodium radicals, shall not exceed 0.30, 0.10, 0.30, 0.03 percent respectively when ascertained in accordance with BS 3921, at the cost of the Contractor.

3.8.4 Erection

3.8.4.1 Block shall be laid true to line, level and laid in accurately spaced courses in stretcher bond with vertical joints of each course located at centre of units in alternate courses below. Vertical joints shall be buttered in the entire height of blocks. Each course shall be bonded. Courses of block shall be kept plumb throughout and corner reveals shall be true and in plumb.

Standard with of mortar joints for both horizontal and vertical joints shall be 7/16 inch (maximum). Mortar joints in wall shall have full mortar coverage on vertical and horizontal faces between the blocks. Mortar joints on wall including struck joints, shall be thoroughly compacted and pressed tight against the edges of the blocks with proper tools. Blocks terminating against soffits of beam or slab construction shall be wedged tight with wedges and the joints shall be packed solidly with mortar between the top of the block and the bottom of slab

or beam. Control expansion joints shall e kept free from mortar or other debris.

Unless otherwise shown on the drawings or specified by the Engineer, the spaces around door frames and other material or built in items shall be solidly filled with mortar. Spaces around the door and window hold fasts shall be filled in with Class C concrete. Work required to be built in with masonry including door frame anchors, wall plugs, dovetail anchors and accessories shall be built in as the erection progresses.

3.8.4.2 The block work shall be carried out in a uniform manner and no portion shall be carried more than one metre above the adjoining one at any times. All masonry shall be kept strictly true and square and the whole properly bonded together and levelled round each floor.

3.8.4.3 Sleeves, Chases, holes, sinking and mortices for other trades shall be correctly located and formed to the sizes as required by the relevant trades. Chiselling of completed walls or the formation of holes shall only be carried out with the approval of the Engineer.

3.8.4.4 Walls of blocks indicated as being non-load bearing shall be constructed on insitu concrete floor slab unit after the floor formwork is struck and the concrete has obtained sufficient strength to support their weight. Toothing into load-bearing walls shall not be permitted.

3.8.4.5 All bolts, anchors, ties, pipe sleeves, flushing metal attachments lintels and the like required to be built into the work shall be correctly inserted and executed as the work proceeds.

3.8.4.6 Walls or partitions abutting concrete columns or walls shall be securely anchored and tied with metal anchors or ties at not more than 18 inches vertical centres. Wall ties cast in with concrete shall be bent down after the removal of form work and shall be securely jointed into the mortar beds of walling.

3.8.5 Curing and Repairs

3.8.5.1 All block masonry shall be water cured and shall be kept wet for at least seven days, by an approved method, which will keep all surfaces to be cured continuously wet. Water used for curing shall meet the requirements of specifications for water used in the manufacture of blocks.

3.8.5.2 Tolerances

All block work shall be erected plumb and true to line and level with the maximum variation in any storey height or any length of wall being one mm in one metre. The maximum tolerance in the length, height or width of any single masonry wall shall be $\pm$ 1/8 inch.

3.8.5.3 If, after the completion of any block masonry work, the block is not in alignment or level, or does not, conform to the lines and grades shown on the Drawings or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Engineer grants permission, in writing, to patch or replace the defective area.

3.9 MEASUREMENT AND PAYMENT

3.9.1 Material (Brick and cement concrete block work)

Measurement and payment for brick/cement concrete block work shall be made in accordance with the provisions given hereafter.

3.9.1.1 Method of Measurement

Measurement for brick/block work shall include number of cubic ft. of brick/block work provided within the limits as shown on the Drawings or as directed by the Engineer.

3.9.1.2 Basis of Payment

Payment for brick/block work shall be made at the contract unit price per cubic feet. Payment shall constitute full compensation for furnishing all materials, equipment and labour including all incidentals necessary to complete the work:

Pay Item	D e s c r i p t i o n	Unit
3.1	Provide and Lay Brick Masonry with cement sand mortar in foundation and super structures.	Cft.
3.2	Provide and Lay Block Masonry with cement sand mortar in foundation and super structures.	Cft.

SECTION - 4

SURFACE RENDERING

4.1 SCOPE

The work covered by this part of the Specifications consists of supplying all materials, labour, equipment, appliances in performing all operations required for doing the work of cement plastering, pointing, and white washing in accordance with the herein stated requirements except when specifically modified by the Engineer.

4.2 CEMENT PLASTER

4.2.1 General

The work to be carried out under this item shall consist of providing 1/2" thick plaster in grey cement as specified below. The work shall be carried out in accordance with applicable requirements of British Code of practice 211:1966 or latest revision.

4.2.2 Materials

4.2.2.1 Cement

All cement required for incorporation in this Section shall conform to the applicable requirements of Section "CONCRETE"

4.2.2.2 Sand

The sand shall be of medium to coarse grain and having a fineness modulus varying between 1.10 to 1.50 obtained from an approved quarry e.g. Lawrencepur/Local. The material shall be free from clay, vegetable matters and other impurities. Sand bearing clay shall be washed at the discretion of the Engineer.

4.2.2.3 Water

Water required for cement sand paste and curing purposes shall conform to applicable requirements of Section "CONCRETE"

4.2.3 Mortar Composition

Mortar for plastering shall consist of one part of Portland cement to 3 parts of sand by volume.

4.2.4 Material Batching

Material batching for preparation of mortar shall conform to stipulations and requirements set for in the Section "BRICK AND CEMENT CONCRETE BLOCK WORK".

4.2.5 Application of Plaster

The surface on which plaster is to be applied shall in case of brick work, be properly raked and wetted before application of plaster. Plaster shall be applied in a thickness of 1/2". If the specified thickness sis more than 1/2" then plaster shall be applied in two coats viz rendering coat and the final coat. Plaster shall be carried out to the full length of the wall or to the natural points. Vertical or horizontal joints which show themselves shall not be allowed. Rendering coat shall be roughened with waving lines drawn by wire brushes to provide bond for the final coat and it shall be properly moistened before application of subsequent coat. The final coat shall be finished with floats to provide smooth and uniform surface. All arises shall be straight and either truly horizontal or perpendicular and finished with 1/8" radius. Defective finishes if any shall be cut out and re-plastered at the expense of the Contractor. Plaster after finishes shall be kept moist for about 10 days to the satisfaction of Engineer.

4.3 POINTING

4.3.1 Surface Preparation

The joints of brickwork which is to be pointed shall be raked out with a hook to a depth of 1/2". The raking shall be done while the mortar is still green and not later than 48 hours of time of laying. After raking, the brick work is brushed to remove all loose dust from the joints and thoroughly washed with water, all putlog holes shall be filled up before pointing as the scaffolding for masonry has been taken down. The work shall be watered for 24 hours before pointing is done.

4.3.2 Materials

4.3.2.1 Cement

All cement required for incorporation in this section shall conform to the applicable requirements of Section "CONCRETE".

4.3.2.2 Sand

The sand required for incorporation in this Section shall conform to the applicable requirements of "CEMENT PLASTER" as per Clause 4.2.

4.3.2.3 Water

Water required for cement sand paste and curing purposes shall conform to applicable requirements of Section "CONCRETE".

4.3.3 Mortar Composition

Unless otherwise specified, the mortar shall be mixed by volume. The ratio of Cement Sand shall be as specified in the BOQ.

4.3.4 Material Batching

Material batching for preparation of mortar shall conform to stipulations and requirements set forth in Section "BRICK WORK".

4.3.5 Precautions

Before starting work of pointing the following precautions shall be taken.

i) Fine aggregate i.e. sand shall be washed before use.

ii) It shall be ensured that all joints are properly raked.

iii) The surface to be pointed shall be kept moist but excessive moisture shall be avoided.

iv) The scaffolding for pointing shall always be provided double.

4.3.6 Type of Pointing

Unless otherwise specified, the following types of pointing shall be done.

4.3.6.1 Deep or Struck Cement Pointing

This type of pointing shall be done to all un-plastered faces of brickwork where the brickwork is liable to be affected by dampness and saltpeter, such as in the plinths of buildings. The mortar shall be filled in the joints flush with masonry or brickwork with a pointing trowel and then pressed with proper pointing tools. Lining with a spike on a mass of mortar shall not be allowed.

4.3.6.2 Flush Cement Pointing

This type of pointing shall be done at all brickwork with exposed face, when `the finish of the face is not important or when a flush floor surface is required or when the floor or brickwork is subject to wear or to the effects of dampness and saltpeter. The mortar shall be filled and pressed into the joints with a jointing trowel, and finished off level with the edges of the bricks to give the smoothest

possible appearance to the work.

4.3.7 Pointing Tools

The pointing tools for horizontal joint shall be such as to form weathered and struck joints; and for vertical joint, triangles, so as to make a (v) notch. Care shall be taken not to develop a cutting edge in the tools since the idea is to compress the green mortar into the joints and not to cut it away.

4.3.8 Edges of Bricks

The mortar shall not be spread irregularly over the edges and corners of the bricks which shall be left clearly visible. The practice of smearing mortar over defects in bricks, to hide them shall not be allowed and shall render the whole brickwork liable to be rejected.

4.3.9 Washing after Pointing

After pointing, the face of the work shall be cleared off all surplus mortar sticking to the face. No washing shall be done till the pointing has set.

4.3.10 Protection during curing.

After completion, pointing shall be kept for 10 days and shall be protected during that period from extreme fluctuations of temperature and weather

All defects detected during curing or afterwards shall be treated at the Contractor's expenses according to directions of the Engineer.

4.4 PAINTING

The following codes and standards shall be followed wherever relevant and applicable and/or directed by the Engineer.

BS 242-66	Linseed Oil.
BS 245-76	Specification for mineral solvents (white spirit and related hydrocarbon solvents) for paints and other purposes.
BS 2523-83	Lead-based priming paint
BS 2569-64/45	Sprayed metal coatings.
BS 2992-70	Painters and decorators brushes.
BS CP. 3012-72	Cleaning and preparation of metal surfaces.
BS 4800-81	Paint colours for building pruposes.
BS 5082-74	Water-thinned priming paints for wood.
BS 5358-76	Specifications for low-lead solvent-thinned priming paint for woodwork.
BS 6150-82	Code of practice for painting of buildings.

4.4.1 White or Colour Washing

The whitewash shall be made from pure fat lime brought to site of work in the form of un- slaked lime. Water shall be added to this lime in a container until the mixture is of consistency cream and allowed to rest until cracks shall appear on its surface (48-72 hours). After screening through coarse cloth, gum at the rate of 4 oz. boiled with 10 oz. of rice shall be added to each cubic feet of white wash. The colour pigment if required shall be added and mixed with white wash and stirred to give the required shade. Enough quantity shall be prepared in one go so as to meet the requirement of one complete room.

4.4.2 Weather Resistant Paint

4.4.2.1 Selection of Paints

Concrete and Masonry

Cement based paints or one of the three common types of the exterior latex paints (polyvinyl acetate, styrene-butadiene and acrylic) of ICI/Burger make or equivalent shall be used whichever specified. Approved quality cement based or weather resistant emulsion paints shall be used as directed by the Engineer.

4.4.2.2 Primers

Concrete and Masonry

Boiled linseed oil or silicone water repellent primers ICI/Burger make or equivalent shall be used on concrete and masonry surfaces. Before application of paint, concrete and masonry surface should be allowed to dry for at least 3 weeks after cessation of curing.

4.4.2.3 Fillers

Concrete and Masonry

Paste of zinc oxide and varnish thinned with turpentine shall be used as filler on masonry and concrete.

4.4.2.4 Sealers

Concrete and Masonry

Water-insoluble and water-repellent substances dissolved in solvent such as petroleum naphtha or the special clear silicone compounds shall be used to seal masonry surfaces.

4.4.2.5 Thinners

Concrete and Masonry

Thinners such as turpentine, mineral spirit, water, xylene and linseed oil of approved quality shall only be used in accordance with the manufacturers' instructions and with prior approval of the engineer.

4.4.2.6 Brushes

All brushes used for painting work shall conform to B.S 2992 or equivalent American Standards.

4.4.3 Preparation of Surface

All loose material and dirt on the surface shall be removed with a brush. Holes and irregularities of surface shall be repaired with lime putty, and the surface shall be allowed to dry before applying whitewash or colour wash and weather resistant paint. All greasy spots shall be given a coat of rice, water and sand. Surfaces discolored by smoke shall be washed with a mixture of wood ashes and water or yellow earth before being white-washed or painted.

4.4.4 Application

Three coats of white or colour wash shall be applied on the prepared surface with a brush. Paint or finish to any surface shall be applied when ambient temperature is 10 degree centigrade or above and less than 43 degree centigrade unless other wise recommended by the manufacturer. No painting shall be done above 90% relative humidity. Drop cloths shall be placed to adequately protect all finished work.

All paint and coating materials shall be in thoroughly mixed condition at the time of application. All work shall be done in a workman-like manner, leaving the finished surface free from drips, ridges, waves, laps and brush marks. All paints shall be applied under dry and dust free conditions.

All primary paint shall be applied by brushing. The first coat of paint shall be applied immediately after cleaning.

4.5 MEASUREMENT AND PAYMENT

4.5.1 Cement Plaster

Measurement and payment for cement plaster shall be made in accordance with the provisions given hereafter.

4.5.1.1 Method of Measurement

Measurement shall be made of cement plastering for the actual area in square foot in accordance with this section of Specification or as directed by the Engineer.

4.5.1.2 Basis of Payment

Payment shall be made for the number of square foot of surface area cement plastered at the contract unit price per square foot and shall constitute full compensation for furnishing all materials, equipment and labour including all incidentals necessary to complete the work in strict accordance with this Section of Specification.

Pay Item	Description	Unit
4-1	Provide and apply ½" thick 1:3 Cement Sand Plaster for ceiling.	Sq.ft.
4-2	Provide and apply ½" thick 1:4 Cement Sand Plaster for walls.	Sq.ft.

4.5.2 Pointing

Measurement and payment for cement pointing shall be made in accordance with the provisions given hereafter.

4.5.2.1 Method of Measurement

Measurement will be made of cement pointing for the actual area in sq.ft in accordance with this section of Specification or as directed by the Engineer.

4.5.2.2 Basis of Payment

Payment shall be made for the number of square feet of surface area cement pointed at the contract unit price per square feet and shall constitute full compensation for furnishing all materials, equipment and labour including all incidentals necessary to complete the work in strict accordance with this section of specification.

Pay Item	Description	Unit
4-3	Provide and apply Cement Sand mortar	
	i) Flush pointing	Sq.ft
	ii) Struck pointing	Sq.ft

4.5.3 Painting

Measurement and payment for white washing and weather resistant paint shall be made in accordance with the provisions given hereafter.

4.5.3.1 Method of Measurement

The measurement shall be made in sq.ft of the actual surfaces completed and approved.

4.5.3.2 Basis of Payment

Payment shall be made for number of square feet of the actual surface painted measured as provided above at the Contract unit price per square feet for the respective item and shall constitute full compensation for all materials, equipment, labour, including all incidentals necessary to complete the work.

Pay Item	Description	Unit
4.3	Provide and apply white wash.	Sq.ft.
4.4	Provide and apply weather resistant paint.	Sq.ft.
4.3	Provide and apply vinyl emulsion paint.	Sq.ft.
4.4	Provide and apply enamel paint.	Sq.ft.

SECTION - 6

ROOF INSULATION

6.1 SCOPE

The work consists of insulation with brick tiles of sizes 9"x4" x 1 1/2" or any other approved size laid in cement mortar (1:3) over rammed mud laid to grade as shown on drawings after applying two coats of bitumen on the R.C.C. roof slab surface at 30/25 lbs, respectively for first and second coats at specified heat and laying 20 lbs. polythene sheet complete in all respects.

6.2 MATERIALS

The brick tiles shall comply with the standards set in "Section Bricks" except for their thickness and strength. The cement, sand and water shall meet the requirements as given in Section "CONCRETE".

Bitumen shall be PB3 or PB4

The clay for making mud shall be clean, free of all organic and other injurious matters.

6.3 APPLICATION

6.3.1 Bitumen Painting

Bitumen heated to the specified temperature and applied on R.C.C. roof slab cleaned and dried surface including sanding at 1 1/2 cu.ft per hundred sq.ft. of surface.

6.3.2 Laying Mud

The clay shall be mixed with reasonable quantity of water and thoroughly kneaded to form a thick paste to which copped straw at the rate of 10 lbs. per cu.ft of mud shall be added. It shall be laid and thumped with wooden trowels to form the slope as shown on the drawings.

6.3.3 Laying of Tiles

The brick tiles shall be laid in cement mortar (1:3) in fall/slope as shown on drawings.

6.3.4 Pointing

The brick tiles shall then be flush pointed in cement mortar (1:2)

6.3.5 Curing

The tiles laid shall be cured properly for ten days.

6.4 MEASUREMENT AND PAYMENT

6.4.1 Roof Insulation

Measurement and payment for roof insulation shall be made in accordance with the provisions given hereafter.

6.4.1.1 Method of Measurement

The measurement of the roof insulation shall be made in actual area acceptably laid in square feet complete in all respects as per relevant drawing or as directed by the Engineer.

6.4.1.2 Basis of Payment

Payment for roof insulation work shall be made for the number of the sq.ft measured of roof insulation provided above at the Contract Unit Price per sq.ft. It includes the cost of bitumen, mud laying, laying of tiles & pointing and shall constitute full compensation for providing and furnishing all materials, equipment, labour and all incidentals necessary to complete the work in accordance wit the specifications for B.O.Q. items.

Pay Item	D e s c r i p t i o n	Unit
6.1	Provide and Lay Roof insulation earth and tile roofing as per drawing	Sft.

SECTION - 7

FLOORING

7.1 SCOPE

The work covered in this Section consists of furnishing all plant, labour and material etc., and of performing all operations in connection with making cement concrete floor in conformity with lines and dimensions shown on the Drawings and in strict accordance with these specifications.

7.2 MATERIALS

Cement, sand and aggregate shall conform to the requirement of relevant clauses in section "CONCRETE"

7.3 BASE FOR FLOORING

The base for flooring shall be laid down when the earth filling has been done up to the specified level in a layer of 6 inches and has been properly watered and consolidated and correctly leveled.

A layer of sand about 4" thick shall be laid and rammed after having saturated so that a 4" layer is reduced to about 3" after compaction.

Portland cement concrete of Class C (2000 psi) shall be laid in one operation in a uniform layer of specified thickness, absolutely true and parallel to the required level of the finished surface. Concrete shall be cured for at least 7 days before any topping is laid. Before laying the surface shall be washed and scrubbed with wire brushes so that the concrete in the base and the topping are well bounded.

7.4 CEMENT CONCRETE FLOORING

Before laying the topping, the surface of the base shall be divided into symmetrical panels by glass strips. The size of panels, unless otherwise specified, shall not exceed 3 ft. square and concrete shall be placed in alternative panels. The top of the glass strips shall be adjusted to the specified level of the finished floor surface.

Cement concrete floor shall consist of laying a topping of cement concrete of Class B (3000 psi) of specified thickness over the prepared and finished base as or roughed surface of floor slabs.

Placing operation shall be specifically timed. No sooner the concrete has been evenly spread in a panel, then it shall be beaten for about 5 to 10 minutes with "wooden thapies" (about 5 lbs. weight).

Immediately after consolidation, the surface shall be leveled with a wooden trowel. Excessive trowelling in the early stages shall be avoided. The surface shall be tested with a straight edge to detect undulations, which, if found, shall be eliminated. The finer stuff in the concrete which has come to the surface with the stroking shall be quickly but carefully smoothen with the steel trowel. When the concrete has hardened sufficiently, trowelling shall be done with steel trowel. No dry cement or a mixture of dry cement shall be sprinkled on the surface for hardening the surface.

7.5 BRICK FLOORING

The work covered by this item consists of furnishing and laying 4 inch sand over prepared earth to required slope and grade. 3 inch thick layer of Class D (1000 psi) concrete is laid over it and 4.5 inch thick brick on edge are laid in 1:3 cement sand mortar. These joints of these bricks are struck at the top by flush pointing.

7.5.1 Method of Construction

The method consists of placing bricks on edge for flooring in 1:3 cement sand mortar over 4 inch sand and 3inch Class D (1000 psi) concrete and striking the joints of bricks with flush pointing and laid over thoroughly consolidated bottom by ramming and watering before laying this floor.

7.6 CURING

The concrete flooring properly laid shall be cured for 7 days.

7.7 MEASUREMENT AND PAYMENT

7.7.1 Flooring Material

Measurement and payment for concrete flooring, brick flooring and compacted sand fill will be made in accordance with the provisions given hereafter.

7.7.1.1 Method of Measurement

Measurement will be made for the number of square feet of flooring acceptably placed complete in all respects as per drawings and in strict accordance with this section of specification or as directed by the Engineer.

7.7.1.2 Basis of Payment

Payment will be made for the number of square feet of flooring measured as above at the Contract Unit Price per square feet and shall constitute full compensation for all work including earth and sand filling, glass strips, concrete, brick on edge and all other incidentals to complete the work.

Pay Item	D e s c r i p t i o n	Unit
7.1	Provide and Lay compacted 3" sand fill and Cement Concrete Floors using 1/4" thick glass strips for panel.	Sft.
7.2	Provide and Lay compacted 4" sand fill and brick on edge flooring laid over 3 inch thick glass class D concrete.	Sft.
7.3	Provide and Lay dry brick or stone ballast 1-1/2” to 2” gauge under floor.	Cft.
7.4	Provide and Lay PCC class B (300 psi) floor 1-1/2” thick in ground floor laid over dry brick.	Sft
7.4	Provide and Lay floors of 1 inch thick floor of chip tile 12” x 12” x 1” in grey cement over 1” cement mortar 1:4.	Sft

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SECTION - 8

METAL WORKS

8.1 SCOPE

This Section of specification consists of furnishing all plant, labour, equipment and materials in performing all operations in connection with providing and fixing metal works such as shutter, brackets etc. All metal gutters including painting shall be according to the Schedule specified on drawings and manufactured by a firm to be approved by the Engineer. They shall be handled with care, shall be staked on edge on level bearers and be supported evenly against a wall or vertical bearers, under cover.

8.2 CONTRACTOR TO FIX

The Contractor shall fix the windows, doors & rolling shutters as described. He shall be responsible for storing windows etc., and carrying to their respective positions, assembling composites, bedding and jointing with Matic at the mullions and transoms, fixing lugs and screws to frames, placing in the openings and bedding with cement and pointing externally with mastic.

8.3 BUILDING IN

Where applicable metal gutters etc., shall be built in, set to designed slope and geometry. When screwing up lugs or fixing screws, care shall be taken to ensure that shape etc. are not distorted.

8.4 FIXING INTO PREPARED OPENINGS

Gutters etc., to be fixed into prepared slope and alignments and have at least 1/8 inch tolerance all round. Supporting frames shall be chalked with mastic cement of an approved make.

8.5 FABRICATION OF GUTTERS

Shape:

The steel section shall be thoroughly straightened in the shape by methods that will not injure it before being laid off or worked in any way.

Cutting and Forming:

All members shall be so cut and formed that they can be accurately assembled without being unduly cracked strained or forced into position.

Jointing:

The jointing of the different parts of the members of mild steel shall be carried out by welding process in conformity with the requirements of American Welding Society for such joints. Welding points shall be made quite smooth by filling them and making smooth.

Galvanizing:

If required all exterior doors, frames, anchors, reinforcing and related items shall be fabricated from hot dipped galvanized steel, conforming to BS 729 Part 1. Following fabrication, touch up all welds with liquid Zinc. Window frames and ventilators shall be hot dipped galvanized after fabrication conforming to BS 729 Part 1. Following fabrication, touch up all welds with liquid Zinc.

8.6 PUTTY

The putty shall be of a type specially prepared for use with metal work in tropical conditions.

8.7 PROTECTION OF FITTINGS

Fittings shall be wrapped and protected from damage until all rough trades have been completed.

8.8 FABRICATION OF ROLLING SHUTTERS

8.8.1 Gutter

The gutter shall be fabricated using standard galvanized corrugated segments of the required length according to size of the shutter and of 20 gauge thickness. These segments shall be inter linked properly to allow rotation for smooth rolling up and down.

8.8.2 Supporting Frame for Gutter

The supporting frame shall be of standard mild steel. Steel section strong enough to support the load of the gutter with minimum deflection. This support shall have adequate supports at the ends fabricated from mild steel plates. Gutter shall have bracket supports at regular interval based upon the actual site conditions. However, due to space limitation for mounting, the same may be adjusted as per site conditions.

8.8.6 Cover

The cover shall be fabricated from 22 SWG gauge mild steel sheet of uniform shape and size without deformations.

8.10 PAINTING PREPARATION OF THE METAL WORK

Iron and steel surfaces shall be cleaned by means of solvents approved methods. Cleaned surfaces shall be primed as soon as practicable after cleaning.

8.11 PAINT APPLICATION

Unless otherwise specified or instructed the Contractor shall apply paints as follows:

8.11.1 Internal Surfaces of Steel Work

2 coats Zinc Chrome primer
2 under coats
1 glass finish coat

8.11.2 External Surfaces of Steel Work

2 Coats Zinc Chrome Primer
1 aluminium bitumastic under coat
1 aluminium bitumastic finish coat.

All painting coats upto and including the first undercoats, shall be applied under cover at "WORKS" before dispatch to the Site. (The second undercoat and the finishing coat shall be applied after erection on Site). Extreme care shall be taken to protect paint coats during transit.

8.12 PAINT

The paints for any painting sequence shall be mutually compatible and of the same approved manufacture. All paints shall be supplied in small sealed containers each not exceeding one gallon capacity.

8.13 WIRE GAUGE

Unless otherwise specified the wire gauze shall be of best quality as approved by the Engineer uniformly woven wire webbing of 12 x 12 meshes to 645 mm (one sq.inch) made from 22 gauge galvanized iron wire. All panel shall be in one piece and no joints shall be allowed in the gauge.

Wire gauge shall be fixed as shown on the drawings or as directed by the Engineer. The gauze shall remain right to the full width and without any sag.

8.14 MEASUREMENT AND PAYMENT

8.14.1 Gutters

Measurement and payment for steel gutters shall be in accordance with the provisions given hereafter.

8.14.1.1 Method of Measurement

The quantity to be paid for under this item shall be paid as per the actual length covered along slopy roofs complete in all respects as per relevant drawings or as directed by the Engineer.

8.14.1.2 Basis of Payment

Payment shall be made for the actual linear length of the steel gutters doors, as provided above at the Contract Unit Price per RFT. for all supply of items and means of fixing, cutting, shaping, priming, painting as necessary and all other operations required for the complete erection and commissioning to the full satisfaction of the Engineer for the item:

Pay Item	D e s c r i p t i o n	Unit
8.1	Provide, Install and paint Complete Steel gutter, brackets, painting etc.	Rft.

SECTION - 16

MISCELLANEOUS

16.1 SCOPE

The work covered by this section of the specifications consists of furnishing all plants, labour, equipment and materials and of performing all operations in connection with the miscellaneous items in strict accordance with this section of the specifications and the applicable drawings or as directed by the Engineer.

16.2 MATERIALS AND CONSTRUCTION

16.2.1 Steel Work

Structural steel work shall comply in all respects with B.S. 449. Steel for rolled sections shall comply in all respects with B.S. 16. Welding of steel work shall comply with B.S. 1856. High strength bolted connection shall comply with B.S. 3294.

16.2.2 Steel Ladder/Stairs

Steel access ladders shall comply with B.S 4211 unless otherwise stated. Stringers shall be rectangular section measuring 2-1/2 inches by 1/2 inches spaced 15 inches apart and rungs shall be 3/4 inch diameter spaced at 12 inches centre. Hoops shall be of circular pattern and shall be bolted to the stringers so as to be removable. Ladders shall be painted with black enamel paint of an approved make.

Steel stairs shall be as shown on the Drawings or as directed by the Engineer.

16.2.3 Brick Pavement

Bricks for pavement in the water works areas shall comply with the requirements of Section-3 of the technical specifications. Excavation and compacted backfill shall be in accordance with the requirements of Section-1 of the Technical Specifications. Bricks joints shall be sand grouted. Pavement shall be constructed in accordance with the Drawings or as directed by the Engineer.

16.2.4 Level Indicator

Level indicators shall be installed in accordance with the applicable drawings and as directed by the Engineer. The contractor shall be responsible for manufacturing and fixing of all components involved to make it a complete working unit.

16.2.5 Lightening Arrester

Lightening Arrester including all associated copper strip shall be installed strictly in accordance with the applicable drawings and as directed by the Engineer. The Contractor shall be responsible for providing and fixing all copper strips and other components to make it a complete working unit.

16.2.6 Water Storage Tank

1) The water tanks must comply with Pakistan Standards and Quality Control Authority (PSQCA) specifications for plastic storage tanks (PS: 4991-2004) and be made from virgin, food-grade polyethylene, UV-stabilized to prevent degradation. The tanks, with capacities ranging from 1000 liters to 4000 liters, must be rotomolded in a single piece with uniform wall thickness and free from defects.

2) They should have a cylindrical, vertical design with a domed top and flat bottom, a tightly fitting lockable lid, at least one inlet and one outlet with threaded connections, a vent or overflow outlet, and provision for a level indicator. The tanks must also have a designated area for affixing a custom monogram or logo sticker as specified by the client.

3) Each tank must withstand hydrostatic pressure without deformation and be leak-proof, certified for storing potable water, and come with documentation proving compliance with food-grade standards. Each tank must have a RFID chip embedded/embossed and should clearly display a QR code, which when scanned, provides information about the project and safe water use practices for potable and non-potable rainwater usage applications and other education material.

4) Reputable manufacturers like Dura or Popular should supply the tanks, which must have a minimum 5-year warranty against manufacturing defects. Clear installation and maintenance instructions, along with labels indicating the manufacturer's name, capacity, material grade, and date of manufacture, must be included. Suppliers must provide compliance certificates, technical datasheets, and warranty documents with the delivery. Reference image of the tank with logo is attached in the section below.

16.2.7 Toilet Fixtures and Plumbing Works

Toilet fixtures and plumbing works as approved by the Engineer shall be fixed according to standard drawings. The Contractor shall be responsible for proper fixing of the plumbing works strictly in accordance with engineering practice.

This work include complete items to make the system functional.

16.2.8 Water Filter

1) The water filtration system must comply with Pakistan Standards and Quality Control Authority (PSQCA) specifications and applicable ISO standards, specifically ISO 9001:2015 for quality management and ISO 14001:2015 for environmental management. The system should be a three-stage ultrafiltration (UF) type designed for kitchen use with removable and replaceable filters. The first stage must include a 5-micron sediment filter to remove large particles and sediments, the second stage must have a granular activated carbon (GAC) filter to remove chlorine, odors, and organic compounds, and the third stage should use a UF membrane with a pore size of 0.01 microns to remove bacteria and viruses, ensuring the water is potable. The filtration system must be made from food-grade, BPA-free materials compliant with FDA standards. It should be designed for easy installation and maintenance, with each filter stage easily accessible for replacement.

2) The system should feature a compact design suitable for under-sink installation, with inlet and outlet connections compatible with standard plumbing fittings. It must be capable of handling a minimum flow rate of 1.5 liters per minute and operate effectively at water pressures between 1.5 and 4.0 bar. The system should include a user-friendly indicator for filter replacement and come with clear instructions for installation, use, and maintenance. Reputable manufacturers with proven track records should supply the filtration systems. Suppliers must provide compliance certificates, technical datasheets, and warranty documents, ensuring the system meets all required safety and performance criteria. The system must come with a minimum 2-year warranty against manufacturing defects.

16.2.9 Septic Tank

The work shall consist of furnishing all plant, labour equipment, appliances and materials and in performing all operations in connection with construction of Septic Tank including excavation, brick/block work, plastering, concreting, inlet and outlet pipes, manhole covers etc. in accordance with these specifications in the relevant sections and in reasonably close conformity with the lines, grades and dimensions shown in the drawings or directed by the Engineer.

16.2.10 Water Meter

1) Water meters shall be supplied by approved manufacturers such as

KSB, or other equivalent and approved manufacturers, and must comply with relevant international and local standards (e.g., ISO 4064, AWWA C700, etc.).

2) The water meter body shall be made of high-quality materials such as brass, bronze, or stainless steel, suitable for potable water applications. The components including impellers, seals and glass should be durable, made of corrosion free material and of high quality and grade.

3) Water meters shall be available in different sizes as per the size of pipe adopted for the rainwater harvesting system, including but not limited to 1/2-inch, 3/4-inch, 1 inch, or as per the project requirements.

4) Water meters must have an accuracy class of at least Class 1 or Class 2. The starting flow rate, minimum flow rate, and maximum flow rate should conform to the standards specified for the size of the meter. Functional tests, pressure tests, and accuracy tests must be conducted to ensure proper operation. A minimum warranty period of one year from the date of commissioning should be provided.

16.3 MEASUREMENT AND PAYMENT

16.3.1 Miscellaneous Items

Measurement and payment for miscellaneous items will be made in accordance with the provisions of this clause specified hereinafter.

16.3.1.1 Method of Measurement

Rolled Section Steel will be measured by the length in linear ft. for the work satisfactorily completed as shown in the Drawings or as directed by the Engineer.

Steel ladder/stairs will be measured by the length in linear ft. for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Brick Pavement will be measured by the area in square foot for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Level indicators shall be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Lightening Arrester shall be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Disinfection of overhead water tanks will be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Malleable cast iron rungs shall be measured by the number for the work satisfactorily provided & laid as shown on the drawing or as directed by the Engineer.

Manhole covers shall be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Air vents shall be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Concrete service ducts shall be measured by the number of linear foot of duct satisfactorily provided & laid as shown on the drawing or as directed by the Engineer.

Mild steel bar screen and galvanized mild steel grating shall be measured by the area in the square ft. for the work satisfactorily provided & installed as shown on the drawings or as directed by the Engineer.

No measurement for fixtures along with plumbing works will be made. Lump sum will be the basis for payment.

Measurement will be made for each item of fan and accessories all acceptably supplied and installed by the contractor as a complete unit.

Septic Tank along with items as shown in the drawing shall be measured by the number for the work satisfactorily completed as directed by the Engineer.

Penstock gate alongwith complete assembly and fixation as shown in the drawing shall be measured by the number for the work satisfactorily completed as shown on the drawing or as directed by the Engineer.

16.3.1.2 Basis of Payment

Payment will be made in accordance with the unit prices in the Bill of Quantities of the various items in accordance with the specifications and shall constitute full compensation for furnishing all materials, equipment and labour and for performing all operations necessary to complete the work.

Pay Item	Description	Unit
16.1	Provide, fix and paint rolled steel section.	Lft.
16.2	Provide and lay brick pavement as shown on drawings or as directed by the Engineer.	Sft.
16.3	Provide and fix level indicator complete in all respects as per drawings and specifications or as directed by the Engineer.	No.
16.4	Provide and fix lightening arrester, copper earth strips and all other accessories complete in all respects as per drawings or as approved by the Engineer.	No.
16.5	Clean, test and disinfect overhead water tank.	No.
16.6	Provide and lay underground concrete service ducts of types as shown on the drawings or as directed by the Engineer.	Lft.
16.7	Provide and fix all toilet fixtures along with plumbing works complete with all accessories fittings, manhole chambers, gully traps, as shown in drawings or as directed by the Engineer	Lump sum
16.8	Construction of septic tank complete in all respects as per drawings and specifications.	No.

SECTION 15411
PLUMBING VALVES

PART 1 GENERAL

1.01 SCOPE OF SECTION

A. This technical specification establishes the type and quality of materials, and the standard of workmanship to be used in the supply and installation of valves.

1.02 WORK INCLUDED

A. The work includes the provision of all labour; materials and the performance of all operations in connection with the supply and installation of valves as specified herein and where referred to on the Drawings.

B. Co-ordination: The contractor shall be responsible for the full co-ordination of the work of all trades.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of valves whose products have been in satisfactory use in similar applications for not less than 10 years.

B. Installer: Firms regularly engaged and qualified in the installation of valves with at least 5 years successful installation experience on projects of a similar nature.

1.04 APPLICABLE CODES AND STANDARDS

A. The valves and all associated materials shall comply fully with the latest relevant British Standards in all respects.

The following are the most commonly used and relevant British Standards associated with valves and associated materials. However, the Contractor shall ensure that all applicable British Standards are complied with, whether listed here or not.

BS: 21	-	Specification for Pipe Threads for Tubes and Fittings where Pressure Tight Joints are made on the Threads.
BS: 4504	-	Circular Flanges for Pipes, Valves and Fittings (PN designated).
BS: 5150	-	Specification for cast iron gate valves.
BS: 5151	-	Cast Iron Gate (Parallel Slide) Valves.
BS: 5152	-	Cast Iron Globe and Globe Stop and Check Valves for general purposes.
BS: 2879	-	Draining taps (screw down pattern).
BS: 5153	-	Cast Iron Check Valves for general purposes.
BS: 5154	-	Copper Alloy Globe, Globe Stop and Check, Check and Gate Valves.
BS: 5155	-	Butterfly valves.

BS: 5156 - Diaphragm Valves.

BS: 6683 - Guide to Installation and Use of Valves.

1.05 SUBMITTALS

A. Drawings - refer to Section 15010

B. Products - submit full manufacturer data for every item.

1.06 OPERATION AND MAINTENANCE DATA

A. Comply with Section 15010.

1.07 WARRANTY

A. Provide 12 month warranty in accordance with contract conditions.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves, cocks, air vents and pipework specialties shall be provided where indicated on the Drawings and at all positions necessary for the proper working, regulation, control and maintenance of the installation with the approval for the Engineer.

B. All valves and cocks shall be suitable for the temperatures, working and test pressures applicable to each system.

C. All valves cocks vents and specialties must be fitted in such a manner that they are accessible for operation and maintenance.

D. All valves, cocks, vents and specialties installed for the work specified in this Contract shall be of the manufacturer specified hereafter or equal and approved by the Engineer.

2.02 VALVES

A. BRASS BALL / GATE VALVE

Valves to be class 125, made of brass with special seal for PPR hot water connection, inlet: soldered socket, outlet: union with drain.

Make: KITZ or approved equal.

B. BACK FLOW PREVENTOR

Back flow Preventor brass check valve class 125 suitable for vertical or horizontal installation. Seat, Cone and cone pressure spring of bronze including all accessories required for connection with piping.

Make: KITZ or approved equal.

C. AIR RELEASE VALVE

Air release valve to be of threaded ends, automatic type with manual drain plugs, cast iron body, aluminum cover, EPDM seat, suitable to be mounted on wall.

D. SAFETY VALVES

Brass body safety relief valve for pressure and temperature, with stainless steel spring (adjustable) suitable for installation on hot water storage tanks and heaters.

PART 3 EXECUTIONS

3.01 STORAGE

A. All valves shall be stored within a well lit container on purpose made compartmented racks or shelves, constructed in a similar manner to support the entire weight of materials without noticeable deformation.

B. The valves shall be separated by means of their type and size and laid out in an orderly manner for ease of identification.

C. Valves shall be supplied and stored with purpose made or manufactured plugs to prevent ingress of dirt.

3.02 GENERAL INSTALLATION

A. Valves with screwed ends shall have a union installed adjacent to the valve for ease of dismantling.

B. Where possible, valves shall be installed with the stem in the vertically upright position. However, all valves shall be installed in a manner such that they are readily accessible for ease of operation.

C. Sufficient clearance shall be allowed for the application of thermal insulation, valve boxes, etc. and to ensure that full travel of the valve stem can be achieved.

3.03 ISOLATING VALVES

A. Separate isolating valves shall be provided on all pipework services to each item of plant or equipment and on each main and sub main, except where flow measuring or regulating valves are required and these valves can be used for isolating purposes without affecting their measuring or regulating functions.

3.04 AIR VENTING DEVICES

A. Air venting devices shall be installed at all system high points.

B. Automatic air eliminators shall be complete with copper relief pipework, taken to within 1.5 m of the floor level with gunmetal isolating valve and extended to a position where any discharge will not damage building fabrics, decorations or the like.

C. Air bottles shall be made from 50mm size tube. Each shall be a minimum of 150mm long, fitted with a cap and 8mm size air cock. Where an air bottle is fixed out of reach, a 15mm extension tube shall be run from the cap to within 1.5m of the floor level and terminating with a needle valve and hose union.

END OF SECTION 15411

SECTION 15410

PLUMBING PIPING

1.0 GENERAL

1.01 SCOPE OF SECTION

A. This technical specification establishes the minimum requirements for the equipment to be incorporated into the above ground Soil, Waste, Rainwater and Hot and Cold water services plumbing pipework.

B. It also establishes the quality of materials and workmanship to be used in the supply and installation of the systems.

1.02 WORK INCLUDED

A. Provision of all labour, materials and the performance of all operations necessary for the supply and installation of pipework and fittings of the above ground Soil, Waste, Rainwater and Hot and Cold water services systems as specified herein and as detailed on the Drawings.

B. Co-ordination: The Contractor shall ensure that the soil and waste systems are fully compatible with all trades, particularly those of the Civil, Mechanical and Electrical services, for successful installation and operation.

C. Submittals: The Contractor shall submit to the Engineer for review and approval, all calculations and drawings for the equipment proposed and associated builder's works to show that the plant as installed will meet all the specified criteria.

No works shall commence on the site until the design has received the approval of the Engineer.

1.03 QUALITY ASSURANCE

A. Manufacturers: The contractor shall only propose the use of materials produced by firms who have been regularly engaged in the manufacture of plumbing pipework systems and whose products have proved satisfactory in similar service for not less than 10 years.

B. Installer: Firms proposed for the installation of the plumbing pipework systems shall have been regularly engaged for at least 5 years in the installation of plants of a similar type, quality and scope as is required for this project.

1.04 APPLICABLE CODES AND STANDARDS

A. The plumbing pipework shall comply fully with the latest relevant British/American and Standards in all respects.

B. The following are the most commonly used and relevant British/American and Standards associated with Soil and Waste Systems. However the Contractor shall ensure that all applicable British/American Standards are complied with, whether listed here or not.

BS 1387 - Galvanized steel medium and heavy duty.

BS: 1740 - Wrought steel pipe fittings.

BS 2494 - Elastomeric joint rings for pipe work and pipelines.

BS 2779 - Pipe threads. For tubes and fittings where pressure-tight joints are not made on the threads

BS: 3380 - Wastes (excluding skeleton sink wastes) and bath overflows.

BS: 3505 - Specification for uPVC pressure pipes.

BS 3605 - Austenitic stainless steel pipes and tubes for pressure purposes.

BS: 3943 - Plastic waste traps.

BS: 3974 - Pipe supports. (Part 1 & 2) BS 4346 - Joints and fittings for use with uPVC pressure pipes.

BS 4346 - Joints and fittings for use with uPVC pressure pipes.

BS 4368 - Compression coupling for tubes.

BS: 4514 - Unplasticized PVC soil and ventilating pipes, fittings and accessories.

BS: 4660 - Unplasticized PVC underground drainpipe and fittings.

BS: 4991 - Specification for Propylene Copolymer Pressure Pipe.

BS 5114 - Performance requirements for joints and compression fittings for use with polyethylene pipes.

BS: 5254 - Polypropylene waste pipe and fittings.

BS: 5255 - Plastic waste pipe and fittings.

BS: 5481 - Unplasticized PVC pipes and fittings for gravity sewers.

BS: 5572 - Sanitary pipework.

BS: 6087 - Flexible joints for grey or ductile cast iron drainpipes and fittings and for discharge and ventilating pipes and fittings.

BS: 6367 - Drainage of roofs and paved areas.

BS 6700 - Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their cartilages.

BS: 8000 - Part 13 - Above ground drainage and sanitary appliances.

BS: EN 545 - Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods.

BS: EN 598 - Ductile iron pipes, fittings accessories and their joints for sewerage applications Requirements and test methods.

ASTM B88 - Specification for Seamless Copper Water Tube.

ASTM B306 - Specification for Copper Drainage Tube (DWV)

ANSI B16.22 - Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings

ANSI B16.29 - Wrought Copper and Copper Alloy Solder - Joint Drainage Fittings

ANSI A135 - Specifications for Electric Resistance Welded Steel Pipe

ASTM A53 - Pipe, steel, Black and not dipped, zinc – coated welded and seamless.

UPC - Uniform Plumbing Code.

1.05 SUBMITTALS

A. Drawings - refer to Section 15010

B. Products - submit full manufacturer data for every item.

1.06 OPERATION AND MAINTENANCE DATA

A. Comply with Section 15010.

1.07 WARRANTY

A. Provide 12 month warranty in accordance with contract conditions

2.0 PART 2 PRODUCTS

2.01 PIPES AND FITTINGS SHALL BE IN ACCORDANCE WITH THE FOLLOWING SCHEDULE: -

Service	Material
Main soil, waste and vent Pipes and Rain water pipes	Un-plasticized polyvinyl chloride (uPVC) Type-B as per BS 3505
Branch waste and vent pipes	Un-plasticized polyvinyl chloride (uPVC) Type-B as per BS 3505
Water Line from Tube well to UGWT	uPVC Class B as per BS 3505
Water Line from KWB's External Line to UGWT	uPVC Class B as per BS 3505
Cold and Hot Water Supply	PPRC PN 20 As per DIN 8077-8078
Condensate drains	Unplasticized polyvinyl chloride (uPVC) Concealed location & G.I. at Roof level and Mechanical room.

2.02 MATERIALS

A.

1. Unplasticized Polyvinyl Chloride (uPVC) pipework and fittings for Soil, Waste and Vent.

2. Pipework shall be installed in uPVC pipes confirming to ISO 3633and EN1329 Sanitary drainage above / under ground or in the wall applications.

3. Jointing of pipework and fittings shall be by the use of solvent weld sockets carried out in accordance with the manufacturer instructions. Solvent weld cement shall be of a type approved by the manufacturer of the pipework being jointed. Or with rubber ring socket Joints (ISO 4633) and all accessories.

4. Additional ring seal joints shall be provided as necessary to account for expansion and contraction.

B. Polypropylene Pipe work and Fittings.

1. Polypropylene PPRC (Green) pipework for hot and cold water supply as per DIN 8077- 8088 for pipes and DIN 16962 for fittings (polyfusion welded joints) inside the Building including all specials.

C. Galvanized Steel pipework (GS)

1. Galvanized steel pipework shall be to ASTM A53 grade A schedule 40.

2. Jointing of pipes shall be by flanged connection. Screwed joints shall not be used.

3. As an alternative to flanged connections Victaulic grooved couplings with EPDM seals may be used.

3.0 EXECUTION

3.01 SOIL, WASTE AND RAINWATER PIPEWORK

A. WORKMANSHIP

1. Materials and workmanship shall be of best quality and executed in accordance with the Specification, drawings and manufacturers recommendations.

2. Where any pipe is required to be shortened it shall be cut off square and cleanly with an approved pipe-cutting machine.

3. Where special joints or jointing materials are shown for pipes of any materials, they shall be of an approved type and manufacture, and the joint shall be made in accordance with the manufacturer's instructions, or as directed.

4. Responsibility shall be assumed to identify and install all necessary expansion couplings and fire sleeves throughout the installations.

5. All plant, pipes and fittings etc shall be thoroughly cleaned of all foreign matter before installation. Each section of the installation shall be clean and free from any obstructions whatsoever before proceeding with the next section of the installation.

6. Flexible joints are to be provided wherever pipes cross expansion joints.

7. All soil, waste, vent and rainwater pipes shall be to the sizes and positions indicated on the drawings to take the discharge from the branch waste and vent pipes, sanitary fittings and equipment adjacent thereto.

8. On completion the whole of the work is to be handed over in a sound and clean condition. In the event of any pipe being fractured from any cause

whatsoever after having been (to all appearances) properly installed, responsibility shall be assumed in every instance and any such defective pipes shall be replaced for approval.

9. All pipework shall be erected to present a neat and orderly appearance, arranged parallel to or at right-angles to the structural members of the buildings, giving maximum headroom and shall not obstruct windows or doorways. Pipework shall be erected such that there is a minimum clearance of 75 mm to finished floor level and a minimum clearance of 25 mm to finished wall faces.

10. Slopes of long-run drainage pipes (gravity) shall be as per design drawings and minimum of:

    3” dia. 1.33%

    4” dia. 1.00%

    6” dia. 0.67%

    8” dia. 0.57%

B. The discharge pipework shall be so installed as to minimize the risk of blockage. Access covers and/or rod ding eyes are to be positioned such as to enable maintenance equipment to be inserted into the system(s) to permit cleaning or clearing of all sections of the system(s).

The pipe work system and fittings are to be installed so that broken or defective parts can be easily removed and replaced.

The discharge pipe work shall ensure that there is no leakage of contaminated water or foul air into any building.

C. The work shall be set out and responsibility assumed for the accuracy of the same and the position of all fittings shall be approved by the Client's representative. When first setting to any work, consideration must be given to the work of other trades.

D. Responsibility shall be assumed for leaving all unfinished works in a safe condition during the progress of the works.

All materials & equipment are to be installed and protected in such manner as to be adequately covered against damage and deterioration, and during the execution of the work the open ends of all pipe work shall be temporarily plugged off by means of blank ends and compression caps respectively.

E. Vent pipe roof termination

1. Discharge stacks complete with domical cages shall terminate not less than 300 mm above the roof, 900 mm above and not less than 3000 mm, measured horizontally from any window or air conditioner.

2. Where the stack passes through floors, ceilings and roofs, the openings are to be perfectly sealed-off by proprietary fittings. They shall terminate with neoprene aluminum weathering slate, weathering collar; and a balloon grating on 180° bend.

F. All branch waste pipes to a range of fittings shall have on access provided on the

pipe in an accessible position at the end of the run.

G. All pipework shall be supported in accordance with the manufacturer recommendations. Pipe hangers and brackets shall be in accordance with section 15412 of this specification.

H. Sleeves shall be provided where pipes pass through walls or floors. Pipe sleeves shall be compatible with the pipes they protect; non-combustible and 1 ½ times the diameter of the pipe. Void between pipe and pipe sleeve shall be packed with mineral wool and sealed with approved mastic sealant.

I. Where plastic pipes 50mm diameter and larger pass through fire compartment walls, floors or ceiling cavity barriers they shall be fitted with in tumescent collars having the same fire resistance rating as the fire barrier they pass through. In tumescent collars shall be as Nullifier B150 pipe collars or approved equal.

J. All pipefitting shall be of the same colour as the pipework used.

K. All vertical soil and waste pipes shall have access doors on each floor fitted above the spillover level of fittings served. Where pipes are installed in ducts or built into walls access doors shall be provided in the duct wall or wall for access to the access door. The type and finish of the access shall be to suit the location and to the approval of the Architect.

L. Connection to sanitary fittings

All outlets shall be trapped and provided with accessible and adequate means of removal and cleaning. The traps shall be designed to be self-cleaning all surfaces and joints are to be smooth.

1. All traps with outlets for pipes up to and including 50 mm shall have a minimum water seal of 75 mm.

2. Traps with outlets for pipes of over 50 mm shall have a minimum water seal of 50 mm.

The waste pipes to the various sanitary fittings shall be of the following minimum sizes:

Wash basins	50-mm diameter
Sinks	50 mm diameter
WC's	110 mm diameter
Floor gullies	75-mm diameter

M. Condensate drains shall be provided from all fan coil units, packaged units etc. piped to the nearest floor drain, other suitable drain point or as indicated on drawings.

N. Drain pipes from fire protection system water test points shall be piped to the nearest suitable drain lines or as indicated on drawings.

O. Self siphon age tests

The contractor shall undertake tests for self-siphon age and induced siphon age in branch discharge pipes by filling each appliance to over flowing and then discharging by removing the plugs and discharging the W.C(s) at the upstream end of the discharge pipe. All seals are to remain in the traps. The numbers of sanitary appliances to be discharged for this performance test are enumerated below:

Type of Use	Number of appliances of each kind on the stack	Number of appliances to be discharged simultaneously		
		WC	Wash basin	Kitchen sink
Domestic	1 to 9	1	1	1
	24 to 24	1	1	2
Congested	1 to 24	1	1	
	5 to 9	1	2	
	10 to 13	2	2	
	14 to 26	2	3	
	27 to 39	3	4	
	40 to 50	3	5	

P. Testing and commissioning

1. All tests requested by Local Municipality on the entire installation shall be carried out, and all necessary appliance and equipment for this purpose shall be supplied.

2. Provision shall be made to carry out any test requested at any time during the progress of the works or after their completion.

3. Whilst phased testing may be carried out (which may or may not have been witnessed) the contractor shall be required to demonstrate the water tightness, alignment, and level and cleanliness of the whole installation seven days prior to the installation being handed over.

4. This requirement shall be discharged by the applying a full running water test to the whole installation as described below and by the drawing through of a drain profile, which will be provided, to the required detail.

5. All tests shall be carried out in the presence of the Client's representative, and a minimum of 48 hours notice shall be given of readiness to test any section of the installation. Test Certificates shall be submitted to the person witnessing the test for their signature of approval, to the effect that the system satisfies the requirements of this Specification.

6. All sections of works must be pretested to satisfy that the system will pass the required test, prior to carrying out the main test.

7. The Test Certificate shall be required to be completed for all sections of the installation.

8. After erection and immediately prior to sealing in, all rainwater, main soil, waste, vent and branch soil, waste pipes, shall be checked throughout for obstructions and finally tested for soundness.

9. The above ground sanitation and rainwater pipe installation shall be subjected to two air tests, one of 75 mm water gauge for a minimum period of 15 minutes prior to connection of sanitary fittings and building in of pipework, and a second air test on completion of the system with all traps and WC's connected when the test pressure shall be 45 mm water gauge for a minimum period of 15 minutes.

10. At start of testing, sanitation and Rainwater Pipework shall be checked for alignment and stability; mechanical joints shall be re-torquing where necessary.

11. Access doors shall be removed, felt washers greased and doors replaced.

12. The whole system shall be ridded through with an appropriately sized disc type plus the allowance shall also be made for testing to the Local Authority requirements and for carrying out separate and independent tests if required.

13. The provision shall also be made for obtaining an acceptance test certificate form the Local Authority on completion of the works. The test for the Local Authority shall be allowed for as an addition to the tests required under this specification.

3.02 HOT AND COLD WATER SERVICES PIPEWORK

A. Product handling

1. All products shall be delivered in manufacturer's original protective packaging. All products shall be inspected at time of delivery for damage and for compliance with Specifications. Any products that are found to be damaged or not in accordance with the Specifications shall immediately be repaired or removed from the site and replaced. Repairs shall not be undertaken before the Engineer's review of Contractor's proposed action.

2. All products shall be handled and stored as recommended by the manufacturer to prevent damage and deterioration. The Contractor shall supply handling equipment such as lifting beams, reinforced canvas slings, protective padding, struts, cradles, etc., required to handle the products without damaging hardware or linings and coatings.

3. Products shall be protected against damage and the ambient conditions both during transport, site storage and immediately up to the time products are installed. Precautions shall be taken to protect the product from mechanical damage and the effects of sunlight and heat, until the backfilling operations have been completed. All site storage areas shall be shaded.

B. Installation of pipework

1. Pipework from the water meter to the inside of the buildings where running

below ground level shall be Polyethylene (P.E) and the distribution within Buildings shall be Polypropylene (PPRC pipes, appropriate for the working pressure. The installation of Polypropylene pipe works (PPRC pipes) should strictly comply with respective approved manufacturer recommendations or DIN 1988, part2.

Joints in buried pipework shall be kept to the absolute minimum. Marker tapes with embedded metal strip shall be laid 150 mm above the pipework. If valves are required, they are to be in a valve chamber with the surface box lettered to indicate what service is below them.

2. The underground pipework shall be laid in 200 mm of sand or stone free bedding material and wherever possible in straight lines to uniform gradients. The clearance between the pipework and footings of the buildings is not to be less than 200 mm. If less, the pipes shall be installed in a flexible sleeve.

3. All pipework shall run vertically or at an inclination of 1^{o} to the horizontal to enable the whole system to be drained off either through the system or through a valve discharging externally with an air gap to prevent contamination by backflow. When the pipework is drained down, air is to be allowed into the system to prevent failure or damage to the hot water cylinder. A manual air inlet value shall be fitted to the high point in the system to achieve this.

4. Where pipes are run chased into walls, floors, etc., all pipework shall be insulated.

5. All pipework shall be erected to present a neat and orderly appearance, arranged parallel to or at right-angles to the structural members of the buildings, giving maximum headroom and shall not obstruct windows or doorways. Pipes shall bend round piers, projections and into recesses forming part of the structural works whether so indicated on the drawings or not. Pipework shall be erected such that there is a minimum clearance of 75 mm to the finished floor level and at least 25 mm to the finished wall faces.

6. All fittings shall, as far as practicable, be the same size as the tubes and pipes connected to them. Bushed outlets will only be accepted if the required outlet size of a fitting is not of standard manufacturer. Eccentric bushings and square tees shall be used where concentric bushing and pitcher tees might cause air to be trapped in the system. Elsewhere, square tees shall be confined to dead-leg branches of domestic hot water supply systems and on cold-water branches to fitting or ranges of fittings.

7. Elbows shall be used, where practicable, in preference to bends. Square elbows will not be permitted.

8. Pipework shall follow the contours of walls and shall be graded to ensure venting and draining. The clearance between pipework (or the insulation) and the wall and any other fixtures shall be not less than 20 mm.

9. Purpose-made sets or springs may be used where it is necessary to deviate from a straight run.

10. Sets or springs in tubes of 50-mm size and above shall be fire-made and tubes shall remain circular after setting.

11. Eccentric reducing sockets shall be used where changes of bore are made in runs of nominally horizontal pipework to facilitate air venting and draining.

12. Tubes shall be reamed after cutting and shall be free from burrs, rust scale and other defects and shall be thoroughly cleaned before erection. Open ends left during the progress of work shall be temporally closed with purpose-made metal or plastic plugs or caps, or blank metal flanges.

13 Where pipework passes through walls, floors or ceilings, sleeves shall be provided. Pipework passing through flooring shall be provided with approved type floor and ceiling plates fastened securely to the pipe. The sleeves to be of the same metal as the pipe.

13. All entry and exit holes to or from a building for pipework services shall be sealed and plugged. For service conditions below 60ºC the sealant shall be mastic compound, above this temperature it shall be silicon rubber. Where the pipework enters the building through a large hole or duct, a mild steel blanking plate not less than 6 mm thick shall be built into the walls of the hole or duct. The service pipes shall pass through clearance sockets welded to the plate and the space between pipe exterior and socket interior shall be sealed and plugged.

14. Pipework of 75 mm size and larger subject to expansion and contraction and hung from supports shall be suspended on swivel hangers unless otherwise agreed.

15. Hangers for horizontal pipework shall be supported in accordance with the requirements of Section 15412-Support, Hangers and Brackets.

16. Piping that is insulated shall be secured by clips that allow sufficient space behind the back of the pipe for the pipe insulation to be properly installed.

17. All pipework shall be installed so that the vertical distance between the discharge point and overflow level of the receiving appliance shall not be less than 25 mm for taps and/or fittings up to and including 20 mm and 70 mm for those over 20 mm to prevent contamination as result of backflow of water.

18. A 15-mm diameter washout pipe, discharging outside the building shall be provided at ground floor level to drain the system. The top of the outlet is to be in excess of 70 mm from the ground or receiver.

19. Double check valve assemblies or other suitable backflow preventer shall be installed on cold water makeup to HVAC equipment and wherever equipment is supplied that may allow backflow.

20. Water hammer arrestors shall be provided on horizontal piping to fixtures and equipment having quick closing valves or flush valves and as indicated

on the drawings.

21. Where drinking water and non-potable water supply points are installed, they shall be clearly marked to provide ready identification. Every drinking water point shall be segregated from fire fighting water supply points. Every drinking water pipe shall be readily distinguishable from other pipes. Drinking water hoses and flexible pipes shall be marked to prevent them being used for cleaning purposes.

22. Double check valve assemblies or other suitable backflow preventer shall be installed on cold water makeup to HVAC equipment and wherever equipment is served that may allow backflow.

23. Water hammer arrestors shall be provided on horizontal piping to fixtures and equipment having quick closing valves or flush valves and as indicated on the drawings.

C. Storage

1. All pipework shall be stored on purpose made pipe racks of welded construction and of sufficient strength to support the entire weight of the materials without any noticeable deformation. The racks shall be such that all pipework is clear of the ground.

2. All black steel pipework shall be given one coat of red oxide paint immediately after delivery and prior to storage. The open ends of the pipework shall be blanked off with purpose made or manufactured plugs.

3. Pipework fittings shall be stored within a well-lit container made compartmented racks or shelves. The fittings shall be separated by means of their type and size and laid out in an orderly manner for ease of identification.

D. System testing

1. The Contractor shall ensure that all pipework is watertight to the satisfaction of the Engineer and shall supply all pressure gauges, meters, hoses, pumps and other temporary supports, equipment and manpower necessary for carrying out pressure tests.

2. The Contractor shall, during testing, check the satisfactory operation of each valve installed under the Contract.

3. Before filling or pressure testing is started the Contractor shall re-check pipes and valves for cleanliness and shall re-check the operation of valves. The open ends of the pipes shall normally be stopped off by blank flanges or capped ends additionally secured where necessary by temporary struts and wedges.

4. Potable water system shall be tested with water to 1.5 times the normal system working pressure or 6 bar whichever is greater while uncovered but adequately anchored. The testing shall be carried out in sections if necessary. If a section should fail the test, the Contractor shall trace and

repair all leaks and defects and retest the section before any further pipes or section of adjacent pipework are laid.

5. The system shall be filled with potable water and all air expelled. After the system has been completely filled, the pressure shall be steadily and gradually increased until the test pressure has been reached. If any loss is recorded, repairs shall be made and the test re-run.

6. Written records of every test clearly identifying the tested system together with time of test and name of testing Engineer in tabulated format shall be submitted for review by the Engineer upon completion of the test.

E. Flushing and disinfection

1. All visible dirt and debris shall be removed from the tank and pipes.

2. The tank and distributing pipes shall be filled with clean, potable water and then drained until empty of all water.

3. The tank shall be filled with clean potable water and supply closed.

4. A measured quantity of sodium hypochlorite solution of a known strength shall be added to the water in the tank to give a free residual chlorine concentration of 50mg/L (50ppm) in the water.

5. The tank shall be left to stand for 1 hour.

6. Each draw off fitting shall be successively opened working progressively away from the tank.

7. Each tap and draw off fitting shall be closed when the water discharged smells of chlorine.

8. The tank shall not be allowed to become empty during this operation. If necessary it shall be refilled and chlorinated as above.

9. The cistern and pipes shall then remain charged for a further 1-hour.

10. The tap furthest from the cistern shall be opened and the level of free residual chlorine in the water discharged from the tap measured. If the concentration of free residual chlorine is less then 30mg/L (30 ppm) the disinfecting process shall be repeated.

11. Finally, the tank and pipes shall remain charged for at least 16 hours and then thoroughly flushed out with clean, potable water until the free residual chlorine concentration at the taps is no greater then 21 mg/L (21ppm).

END OF SECTION 15410

BILL OF QUANTITIES (BOQ)

Attached as Annexure-I

POJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISSIONING OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

(03, 04, 05 MARLA AND 05 GOVT BUILDINGS)

S. No.	Description of Work	House Sizes (Marla)	Food Water Tank (Gallons)	House Number & Govt Buildings	Rate as per Engineer's Estimate Cost	Total Cost	In Millions
1	Rainwater Harvesting System	3	300	10			
2	Rainwater Harvesting System	3	300	1			
3	Rainwater Harvesting System	4	500	12			
4	Rainwater Harvesting System	5	1,000	7			
5	Rainwater Harvesting Systems for Govt Buildings		1,000	5			
6	MIS System						
				35	**Total Cost**		

Rates :-

Standardized items (MRS) as notified by the finance department on the basis of current Market for the period of 2nd BI-ANNUAL (01.07.2024 to 31.12.2024) MURREE) have been followed whereas non standardized prevailing market rates of materials, pipes, fittings, equipment etc. have been provided adding due provision of carriage to site, fixing/ installation, testing, other incidental costs, taxes etc.

ROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'					
SUMMARY OF ENGINEER'S BOQ					
S. No.	**Land Area in 05 Marla**	**Property Units**	**Unit Rate (Rs)**	**Total Amount (Rs)**	**In Millions**
Bill of Quantity (BOQ) of Rainwater Harvesting Systems for 5 Marla Houses – 10 Nos (Food Grade Water Tank 1000 Gallons)					
1	Upto 5 Marla	1	-	-	0.000
			Sub-Total	**-**	**0.000**
			Add 5% PST Cost	**-**	**0.000**
			Total Cost R.s	**-**	**0.000**

Prepared By (Quantity Surveyor) | **Checked by (Design Engineer)** | **Approved and Forwarded by**

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 05 Marla Rain Water Harvesting System (Food Grade Water Tank 1000 Gallons)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
1		**Collection System**					
i	N S	Gutters (Size 8"x6")					
		Providing, Laying fixing and testing Plain Gauge 20 (1.0 mm thick) Galvanized sheet Steel gutter including Spot Angle, nuts, bolts, Painting & Angle Iron Size 1½"x1½"x1/8" the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		Gutters (Length Varies as per Site)	P.Rft	130			
ii	Ch:-23/27-c	**Downspout Rain Water Collection Diverter Vertical Pipe Connected 4" Inch**					
		Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	15			
iii	N S	**Providing and fixing of Unions Ts, Elbows Complete all in respect.**	Each	5			
		Rain Water Over Flow Pipe 4" Inch					
iv	Ch:-23/27-c	Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	10			
		Leaf Screens Filter/Rainy Filter					
v	N S	Providing and fixing of Leaf Screens and as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.	Each	1			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 05 Marla Rain Water Harvesting System (Food Grade Water Tank 1000 Gallons)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
2		**Conveyance System**					
i	N S	**First Flush Diverter 4inch (Filters out initial dirty water before it enters the storage tank)**					
		Providing and fixing of First Flush Diverter as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
ii	N S	**Clean Out Plug**					
		Providing and fixing of Clean Out Plug as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
3		**Storage System 1000 Gallons**					
		Food Grade Water Tank					
i	N S	Providing and fixing Food graded water tank of required capacity 1,000 gallons, in approved Color, labbeled with project logo and a seal of "NOT FOR SALE" marked on tank, complete in all respect as approved and directed by the Engineer Incharge.(White, Green and Blue)					
		Tank 1000 Gallons	Each	1			
		Foundation Pad For Water Tank					
ii	Ch:-7/4-i	Pacca brick work in foundation Pad for Water Tank Cement, sand mortar:- Ratio 1:6 complete in all respect as approved and directed by the Engineer Incharge.	100Cft.	37			
iii	Ch:-11/7-c	Cement plaster of Foundation Pad for Water Tank 1:2 upto 20' (6.00 m) height: ¾" (20 mm) thick complete in all respect as approved and directed by the Engineer Incharge.	100 Sft.	49			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 05 Marla Rain Water Harvesting System (Food Grade Water Tank 1000 Gallons)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
iv	Ch:-10/3	Supplying and filling sand under floor; or plugging in wells.	100 Cft	48			
v	Ch:-6/6-a-iii	(a) (i) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- Ratio (1:2:4))	Cft	14			
vi	Ch:-6/12-b-ii	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- (ii) (Grade-60)	100 Kg	40			
		Painting old surfaces:-					
vii	Ch:-13/4-a-ii	Painting corrugated surfaces, patent roofing, etc. with oil paint.ii) each subsequent coat	100 Sft.	2,250			
4		**Distribution System**					
		Piping for distributing water from the tank to various outlets					
i	Ch:-23/46-c-ii	Providing, laying, testing and commissioning of POLY PROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe cost water supply pipe(Dadex/Popular/Beta orapproved equivalent manufacturer, with specified pressure rating PN (PRESSURENOMINAL) and conforming to DIN8077- 8078codei/ccost of solvent, specials, making jharries complete in all respect as approvedand directed by Engineer Incharge.(Interna l/ External Diameters mentioned. For (Wash Room & Kitchen)					
		PN-25 pipe 3/4" 25 mm Dia	R.ft	70			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 05 Marla Rain Water Harvesting System (Food Grade Water Tank 1000 Gallons)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
		Taps					
ii	N S	Providing and fixing chrome plated bib cock 1.5 cm (½") for Wash Room / kitchen	Each	2			
iii	N S	Providing and fixing Jumbo sand water filter Specification PRE-FILTER 5 MIC: Filter out solid sediment, mud and rust from the feed water up to 5 mic. CARBON PRE-FILTER: Activated Carbon Filter out color, odor, chemical (For Example: Chloride Working pressure: ≤0.4mpa,Working temperature: 0-49°C, Color: Blue,Size: 2.5*20 inch complete in all respect as per drawing & site engineer incharge. for kitchen	Each	1			
5		**Stainless Steel Plate with Engraving**					
	N S	Stainless Steel Plate with Engraving	Each	1			
6		**Ball Valve**					
	Ch:-23/45-ii	Providing and fixing CP heavy duty brass Ball valve with CP handle ofspecified diameter made of Faisal/Sonex / Master best quality or equivalent complete in all respect as approved and directed by the Engineer Incharge. ii) 3/4" dia	Each	1			
7		**Water Meter**					
	N.s	Providing and fixing Water Meter DN-20	Each	1			
8		**Water Level Indicator**					
	N.s	Providing and fixing Water level indicator including the required electrical relay, complete in all respects and as per satisfaction of the Engineer Incharge.	Each	1			
Total Amount Rs one Unit Cost for 5 Marla						**0**	

Prepared By
(Quantity Surveyor)

Checked by
(Design Engineer)

Approved and Forwarded by
(General Manager)

ROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'					
SUMMARY OF ENGINEER'S BOQ					
S. No.	**Land Area in 4 Marla**	**Property Units**	**Unit Rate (Rs)**	**Total Amount (Rs)**	**In Millions**
Bill of Quantity (BOQ) of Rainwater Harvesting Systems for 4 Marla Houses – 10 Nos (Food Grade Water Tank 500 Gallons)					
1	Upto 4 Marla	1	0	0	0.000
			Sub-Total	**0**	**0.000**
			Add 5% PST Cost	**0**	**0.000**
			Total Cost R.s	**0**	**0.000**

Prepared By (Quantity Surveyor) | **Checked by (Design Engineer)** | **Approved and Forwarded by**

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 04 Marla Rain Water Harvesting System (Food Grade Water Tank 500 Gallons)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
1		**Collection System**					
i	N S	Gutters (Size 6"x5")					
		Providing, Laying fixing and testing Plain Gauge 20 (1.0 mm thick) Galvanized sheet Steel gutter including Spot Angle, nuts, bolts, Painting & Angle Iron Size 1½"x1½"x⅛" the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		Gutters (Length Varies as per Site)	P.Rft	120			
ii	Ch:-23/27-c	**Downspout Rain Water Collection Diverter Vertical Pipe Connected 4" Inch**					
		Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	15			
iii	N S	Providing and fixing of Unions Ts, Elbows Complete all in respect.	Each	5			
		Rain Water Over Flow Pipe 4" Inch					
iv	Ch:-23/27-c	Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	10			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 04 Marla Rain Water Harvesting System (Food Grade Water Tank 500 Gallons)							
		Leaf Screens Filter/Rainy Filter					
v	N S	Providing and fixing of Leaf Screens and as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
2		**Conveyance System**					
i	N S	**First Flush Diverter 4inch (Filters out initial dirty water before it enters the storage tank)**					
		Providing and fixing of First Flush Diverter as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
ii	N S	**Clean Out Plug**					
		Providing and fixing of Clean Out Plug as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
3		**Storage System 500 Gallons**					
		Food Grade Water Tank					
i	N S	Providing and fixing Food graded water tank of required capacity 500 gallons, in approved Color, labbeled with project logo and a seal of "NOT FOR SALE" marked on tank, complete in all respect as approved and directed by the Engineer Incharge.(White, Green and Blue)					
		Tank 500 Gallons	Each	1			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 04 Marla Rain Water Harvesting System (Food Grade Water Tank 500 Gallons)							
		Foundation Pad For Water Tank					
ii	Ch:-7/4-i	Pacca brick work in foundation Pad for Water Tank Cement, sand mortar:- Ratio 1:6 complete in all respect as approved and directed by the Engineer Incharge.	100Cft.	23			
iii	Ch:-11/7-c	Cement plaster of Foundation Pad for Water Tank 1:2 upto 20' (6.00 m) height: ¾" (20 mm) thick complete in all respect as approved and directed by the Engineer Incharge.	100 Sft.	31			
iv	Ch:-10/3	Supplying and filling sand under floor; or plugging in wells.	100 Cft	15			
v	Ch:-6/6-a-iii	(a) (i) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- Ratio (1:2:4))	Cft	6			
vi	Ch:-6/12-b-ii	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- (ii) (Grade-60)	100 Kg	18			
		Painting old surfaces:-					
vii	Ch:-13/4-a-ii	Painting corrugated surfaces, patent roofing, etc. with oil paint.ii) each subsequent coat	100 Sft.	1,750			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 04 Marla Rain Water Harvesting System (Food Grade Water Tank 500 Gallons)							
4		**Distribution System**					
		Piping for distributing water from the tank to various outlets					
i	Ch:-23/46-c-ii	Providing, laying, testing and commissioning of POLY PROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe cost watersupplypipe(Dadex/Popular/Betaorapprovedequivalentmanufacturer,withspecifiedpressureratingPN(PRESSURENOMINAL)andconformingtoDIN8077-8078codei/ccost of solvent, specials, making jharries complete in all respect as approvedand directed by Engineer					
		PN-25 pipe 3/4" 25 mm Dia	R.ft	70			
		Taps					
ii	N S	Providing and fixing chrome plated bib cock 1.5 cm (½") for Wash Room / kitchen	Each	2			
iii	N S	Providing and fixing Jumbo sand water filter Specification PRE-FILTER 5 MIC: Filter out solid sediment, mud and rust from the feed water up to 5 mic. CARBON PRE-FILTER: Activated Carbon Filter out color, odor, chemical (For Example: Chloride Working pressure: ≤0.4mpa,Working temperature: 0-49℃, Color: Blue,Size: 2.5*20 inch complete in all respect as per drawing & site engineer incharge. for kitchen	Each	1			
5		**Stainless Steel Plate with Engraving**					
	N S	Stainless Steel Plate with Engraving	Each	1			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 04 Marla Rain Water Harvesting System (Food Grade Water Tank 500 Gallons)							
6		**Ball Valve**					
	Ch:-23/45-ii	Providing and fixing CP heavy duty brass Ball valve with CP handle ofspecified diameter made of Faisal/Sonex / Master best quality or equivalent complete in all respect as approved and directed by the Engineer Incharge. ii) 3/4" dia	Each	1			
7		**Water Meter**					
	N.s	Providing and fixing Water Meter DN-20	Each	1			
8		**Water Level Indicator**					
	N.s	Providing and fixing Water level indicator including the required electrical relay, complete in all respects and as per satisfaction of the Engineer Incharge.	Each	1			
		Total Amount Rs one Unit Cost for 4 Marla				-	

Prepared By
(Quantity Surveyor)

Checked by
(Design Engineer)

Approved and Forwarded by
(General Manager)

ROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'					
SUMMARY OF ENGINEER'S BOQ					
S. No.	Land Area in 03 Marla	Property Units	Unit Rate (Rs)	Total Amount (Rs)	In Millions
Bill of Quantity (BOQ) of Rainwater Harvesting Systems for 3 Marla Houses – 5 Nos (Food Grade Water Tank 300 Gallon)					
1	Upto 03 Marla	1	-	-	0.000
			Sub-Total	**-**	**0.000**
			Add 5% PST Cost	**-**	**0.000**
			Total Cost R.s	**-**	**0.000**

Prepared By (Quantity Surveyor) | **Checked by (Design Engineer)** | **Approved and Forwarded by**

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 03 Marla Rain Water Harvesting System (Food Grade Water Tank 300 Gallon)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
1		**Collection System**					
		Gutters (Size 5"x5")					
i	N S	Providing, Laying fixing and testing Plain Gauge 20 (1.0 mm thick) Galvanized sheet Steel gutter including Spot Angle, nuts, bolts, Painting & Angle Iron Size 1 ½ " x 1 ½ " x 1/ 8 " the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		Gutters (Length Varies as per Site)	P.Rft	110			
		Downspout Rain Water Collection Diverter Vertical Pipe Connected 4" Inch					
ii	Ch:-23/27-c	Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	15			
iii	N S	Providing and fixing of Unions Ts, Elbows Complete all in respect.	Each	5			
		Rain Water Over Flow Pipe 4" Inch					
iv	Ch:-23/27-c	Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	10			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 03 Marla Rain Water Harvesting System (Food Grade Water Tank 300 Gallon)							
		Leaf Screens Filter/Rainy Filter					
v	N S	Providing and fixing of Leaf Screens and as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
2		**Conveyance System**					
i	N S	**First Flush Diverter 4inch (Filters out initial dirty water before it enters the storage tank)**					
		Providing and fixing of First Flush Diverter as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
ii	N S	**Clean Out Plug**					
		Providing and fixing of Clean Out Plug as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
3		**Storage System 300 Gallons**					
		Food Grade Water Tank					
i	N S	Providing and fixing Food graded water tank of required capacity 300 gallons, in approved Color, labbeled with project logo and a seal of "NOT FOR SALE" marked on tank, complete in all respect as approved and directed by the Engineer Incharge.(White, Green and Blue)					
		Tank 300 Gallons	Each	1			
		Foundation Pad For Water Tank					
ii	Ch:-7/4-i	Pacca brick work in foundation Pad for Water Tank Cement, sand mortar:- Ratio 1:6 complete in all respect as approved and directed by the Engineer Incharge.	100Cft.	23			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 03 Marla Rain Water Harvesting System (Food Grade Water Tank 300 Gallon)							
iii	Ch:-11/7-c	Cement plaster of Foundation Pad for Water Tank 1:2 upto 20' (6.00 m) height: ¾" (20 mm) thick complete in all respect as approved and directed by the Engineer Incharge.	100 Sft.	123			
iv	Ch:-10/3	Supplying and filling sand under floor; or plugging in wells.	100 Cft	15			
v	Ch:-6/6-a-iii	(a) (i) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- Ratio (1:2:4))	Cft	6			
vi	Ch:-6/12-b-ii	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- (ii) (Grade-60)	100 Kg	18			
		Painting old surfaces:-					
vii	Ch:-13/4-a-ii	Painting corrugated surfaces, patent roofing, etc. with oil paint.ii) each subsequent coat	100 Sft.	1,410			
4		**Distribution System**					
		Piping for distributing water from the tank to various outlets					
i	Ch:-23/46-c-ii	Providing, laying, testing and commissioning of POLY PROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe cost watersupplypipe(Dadex/Popular/Betaorapprove dequivalentmanufacturer,withspecifiedpressurerat ingPN(PRESSURENOMINAL)andconformingtoDI N8077-8078codei/ccost of solvent, specials, making jharries complete in all respect as approvedand directed by Engineer Incharge.(Interna l/ External Diameters mentioned. For (Wash Room & Kitchen)					
		PN-25 pipe 3/4" 25 mm Dia	R.ft	60			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 03 Marla Rain Water Harvesting System (Food Grade Water Tank 300 Gallon)							
		Taps					
ii	N S	Providing and fixing chrome plated bib cock 1.5 cm (½") for Wash Room / kitchen	Each	2			
iii	N S	Providing and fixing Jumbo sand water filter Specification PRE-FILTER 5 MIC: Filter out solid sediment, mud and rust from the feed water up to 5 mic. CARBON PRE-FILTER: Activated Carbon Filter out color, odor, chemical (For Example: Chloride Working pressure: ≤0.4mpa,Working temperature: 0-49°C, Color: Blue,Size: 2.5*20 inch complete in all respect as per drawing & site engineer incharge. for kitchen	Each	1			
5		**Stainless Steel Plate with Engraving**					
	N S	Stainless Steel Plate with Engraving	Each	1			
6		**Ball Valve**					
	Ch:-23/45-ii	Providing and fixing CP heavy duty brass Ball valve with CP handle ofspecified diameter made of Faisal/Sonex / Master best quality or equivalent complete in all respect as approved and directed by the Engineer Incharge. ii) 3/4" dia	Each	1			
7		**Water Meter**					
	N.s	Providing and fixing Water Meter DN-20	Each	1			
8		**Water Level Indicator**					
	N.s	Providing and fixing Water level indicator including the required electrical relay, complete in all respects and as per satisfaction of the Engineer Incharge.	Each	1			
		Total Amount Rs one Unit Cost for 3 Marla				**-**	

Prepared By
(Quantity Surveyor)

Checked by
(Design Engineer)

Approved and Forwarded by
(General Manager)

ROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'					
SUMMARY OF ENGINEER'S BOQ					
S. No.	**Land Area in 03 Marla**	**Property Units**	**Unit Rate (Rs)**	**Total Amount (Rs)**	**In Millions**
Bill of Quantity (BOQ) of Rainwater Harvesting Systems for 3 Marla Houses – 5 Nos (Food Grade Water Tank 300 Gallon)					
1	Upto 03 Marla	1	-	-	0.00
			Sub-Total	**-**	**0.00**
			Add 5% PST Cost	**-**	**0.00**
			Total Cost R.s	**-**	**0.00**

Prepared By (Quantity Surveyor) | **Checked by (Design Engineer)** | **Approved and Forwarded by**

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 03 Marla Rain Water Harvesting System (Food Grade Water Tank 300 Gallon)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
1		**Collection System**					
i	N S	Gutters (Size 6"x3")					
		Providing, Laying and fixing uPVC class B pipe, rain gutter including Spot Angle, nuts, bolts, Painting & Angle Iron Size 1½"x1½"x1/8" the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		Gutters (Length Varies as per Site)	P.Rft	110			
ii	Ch:-23/27-c	**Downspout Rain Water Collection Diverter Vertical Pipe Connected 4" Inch**					
		Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	15			
iii	N S	Providing and fixing of Unions Ts, Elbows Complete all in respect.	Each	5			
		Rain Water Over Flow Pipe 4" Inch					
iv	Ch:-23/27-c	Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	10			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 03 Marla Rain Water Harvesting System (Food Grade Water Tank 300 Gallon)							
		Leaf Screens Filter/Rainy Filter					
v	N S	Providing and fixing of Leaf Screens and as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
2		**Conveyance System**					
i	N S	**First Flush Diverter 4inch (Filters out initial dirty water before it enters the storage tank)**					
		Providing and fixing of First Flush Diverter as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
ii	N S	**Clean Out Plug**					
		Providing and fixing of Clean Out Plug as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
3		**Storage System 300 Gallons**					
		Food Grade Water Tank					
i	N S	Providing and fixing Food graded water tank of required capacity 300 gallons, in approved Color, labbeled with project logo and a seal of "NOT FOR SALE" marked on tank, complete in all respect as approved and directed by the Engineer Incharge.(White, Green and Blue)					
		Tank 300 Gallons	Each	1			
		Foundation Pad For Water Tank					
ii	Ch:-7/4-i	Pacca brick work in foundation Pad for Water Tank Cement, sand mortar:- Ratio 1:6 complete in all respect as approved and directed by the Engineer Incharge.	100Cft.	23			
iii	Ch:-11/7-c	Cement plaster of Foundation Pad for Water Tank 1:2 upto 20' (6.00 m) height: ¾" (20 mm) thick complete in all respect as approved and directed by the Engineer Incharge.	100 Sft.	123			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 03 Marla Rain Water Harvesting System (Food Grade Water Tank 300 Gallon)							
iv	Ch:-10/3	Supplying and filling sand under floor; or plugging in wells.	100 Cft	15			
v	Ch:-6/6-a-iii	(a) (i) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- Ratio (1:2:4))	Cft	6			
vi	Ch:-6/12-b-ii	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- (ii) (Grade-60)	100 Kg	18			
		Painting old surfaces:-					
vii	Ch:-13/4-a-ii	Painting corrugated surfaces, patent roofing, etc. with oil paint.ii) each subsequent coat	100 Sft.	1,410			
4		**Distribution System**					
		Piping for distributing water from the tank to various outlets					
i	Ch:-23/46-c-ii	Providing, laying, testing and commissioning of POLY PROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe cost watersupplypipe(Dadex/Popular/Betaorapprove dequivalentmanufacturer,withspecifiedpressurera tingPN(PRESSURENOMINAL)andconformingto DIN8077-8078codei/ccost of solvent, specials, making jharries complete in all respect as approvedand directed by Engineer Incharge.(Interna l/ External Diameters mentioned. For (Wash Room & Kitchen)					
		PN-25 pipe 3/4" 25 mm Dia	R.ft	60			
		Taps					
ii	N S	Providing and fixing chrome plated bib cock 1.5 cm (½") for Wash Room / kitchen	Each	2			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For 03 Marla Rain Water Harvesting System (Food Grade Water Tank 300 Gallon)							
iii	N S	Providing and fixing Jumbo sand water filter Specification PRE-FILTER 5 MIC: Filter out solid sediment, mud and rust from the feed water up to 5 mic. CARBON PRE-FILTER: Activated Carbon Filter out color, odor, chemical (For Example: Chloride Working pressure: ≤0.4mpa,Working temperature: 0-49℃, Color: Blue,Size: 2.5*20 inch complete in all respect as per drawing & site engineer incharge. for kitchen	Each	1			
5		**Stainless Steel Plate with Engraving**					
	N S	Stainless Steel Plate with Engraving	Each	1			
6		**Ball Valve**					
	Ch:-23/45-ii	Providing and fixing CP heavy duty brass Ball valve with CP handle ofspecified diameter made of Faisal/Sonex / Master best quality or equivalent complete in all respect as approved and directed by the Engineer Incharge. ii) 3/4" dia	Each	1			
7		**Water Meter**					
	N.s	Providing and fixing Water Meter DN-20	Each	1			
8		**Water Level Indicator**					
	N.s	Providing and fixing Water level indicator including the required electrical relay, complete in all respects and as per satisfaction of the Engineer Incharge.	Each	1			
		Total Amount Rs one Unit Cost for 3 Marla				**-**	

Prepared By
(Quantity Surveyor)

Checked by
(Design Engineer)

Approved and Forwarded by
(General Manager)

ROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'					
SUMMARY OF ENGINEER'S BOQ					
S. No.	Land Area in 05 Marla	Property Units	Unit Rate (Rs)	Total Amount (Rs)	In Millions
Bill of Quantity (BOQ) of Rainwater Harvesting Systems for Govt Buildings – 10 Nos (Food Grade Water Tank 1000 Gallons)					
1	Govt Buildings	1	-	-	0.000
			Sub-Total	-	0.000
			Add 5% PST Cost	-	0.000
			Total Cost R.s	-	0.000

Prepared By (Quantity Surveyor) | **Checked by (Design Engineer)** | **Approved and Forwarded by**

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For Rainwater Harvesting Systems for Govt Buildings (Food Grade Water Tank 1000 Gallons)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
1		**Collection System**					
i	N S	Gutters (Size 8"x6")					
		Providing, Laying fixing and testing Plain Gauge 20 (1.0 mm thick) Galvanized sheet Steel gutter including Spot Angle, nuts, bolts, Painting & Angle Iron Size 1½"x1½"x1/8" the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		Gutters (Length Varies as per Site)	P.Rft	152			
ii	Ch:-23/27-c	**Downspout Rain Water Collection Diverter Vertical Pipe Connected 4" Inch**					
		Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	15			
iii	N S	**Providing and fixing of Unions Ts, Elbows Complete all in respect.**	Each	5			
		Rain Water Over Flow Pipe 4" Inch					
iv	Ch:-23/27-c	Providing, fixing, testing, and commissioning of Downspout Rain Water Collection Diverter Vertical Pipe including the cost of complete in all respects, as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.					
		PVC/ uPVC pipes of B.S.S. with `D' 4" i/d (100 mm) (Length Varies as per Site)	P.Rft	10			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'							
BOQ For Rainwater Harvesting System at Murree							
ABSTRACT OF ENGINEER'S BOQ							
S. No.	**Ref No/ Item Code**	**Description of Items**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount (Rs)**	**Remarks**
BOQ For Rainwater Harvesting Systems for Govt Buildings (Food Grade Water Tank 1000 Gallons)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
		Leaf Screens Filter/Rainy Filter					
v	N S	Providing and fixing of Leaf Screens and as per drawings & specifications and /or as approved and directed by the Engineer Incharge Complete all in respect.	Each	1			
2		**Conveyance System**					
i	N S	**First Flush Diverter 4inch (Filters out initial dirty water before it enters the storage tank)**					
		Providing and fixing of First Flush Diverter as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
ii	N S	**Clean Out Plug**					
		Providing and fixing of Clean Out Plug as per drawings & specifications and /or asapproved and directed by the Engineer Incharge Complete all in respect.	Each	1			
3		**Storage System 1000 Gallons**					
		Food Grade Water Tank					
i	N S	Providing and fixing Food graded water tank of required capacity 1,000 gallons, in approved Color, labbeled with project logo and a seal of "NOT FOR SALE" marked on tank, complete in all respect as approved and directed by the Engineer Incharge.(White, Green and Blue)					
		Tank 1000 Gallons	Each	1			
		Foundation Pad For Water Tank					
ii	Ch:-7/4-i	Pacca brick work in foundation Pad for Water Tank Cement, sand mortar:- Ratio 1:6 complete in all respect as approved and directed by the Engineer Incharge.	100Cft.	37			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For Rainwater Harvesting Systems for Govt Buildings (Food Grade Water Tank 1000 Gallons)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
iii	Ch:-11/7-c	Cement plaster of Foundation Pad for Water Tank 1:2 upto 20' (6.00 m) height: ¾" (20 mm) thick complete in all respect as approved and directed by the Engineer Incharge.	100 Sft.	49			
iv	Ch:-10/3	Supplying and filling sand under floor; or plugging in wells.	100 Cft	48			
v	Ch:-6/6-a-iii	(a) (i) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- Ratio (1:2:4))	Cft	14			
vi	Ch:-6/12-b-ii	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- (ii) (Grade-60)	100 Kg	40			
		Painting old surfaces:-					
vii	Ch:-13/4-a-ii	Painting corrugated surfaces, patent roofing, etc. with oil paint.ii) each subsequent coat	100 Sft.	2,475			
4		**Distribution System**					
		Piping for distributing water from the tank to various outlets					
i	Ch:-23/46-c-ii	Providing, laying, testing and commissioning of POLY PROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe cost watersupplypipe(Dadex/Popular/Betaorapproved equivalentmanufacturer,withspecifiedpressureratin g PN (PRESSURENOMINAL) and conforming to DIN8077-8078codei/ccost of solvent, specials, making jharries complete in all respect as approvedand directed by Engineer Incharge.(Interna l/ External Diameters mentioned. For (Wash Room & Kitchen)					
		PN-25 pipe 3/4" 25 mm Dia	R.ft	150			

PROJECT NAME:- HIRING OF CONTRACTOR SERVICES FOR PROCUREMENT, INSTALLATION, TESTING COMMISISONG OF ROOF TOP RAINWATER HARVESTING SYSTEM IN MURREE CITY'

BOQ For Rainwater Harvesting System at Murree

ABSTRACT OF ENGINEER'S BOQ

S. No.	Ref No/ Item Code	Description of Items	Unit	Quantity	Unit Rate (Rs)	Total Amount (Rs)	Remarks
BOQ For Rainwater Harvesting Systems for Govt Buildings (Food Grade Water Tank 1000 Gallons)							
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
		Taps					
ii	N S	Providing and fixing chrome plated bib cock 1.5 cm (½") for Wash Room / kitchen	Each	2			
5		**Stainless Steel Plate with Engraving**					
	N S	Stainless Steel Plate with Engraving	Each	1			
6		**Ball Valve**					
	Ch:-23/45-ii	Providing and fixing CP heavy duty brass Ball valve with CP handle ofspecified diameter made of Faisal/Sonex / Master best quality or equivalent complete in all respect as approved and directed by the Engineer Incharge. ii) 3/4" dia	Each	1			
7		**Water Meter**					
	N.s	Providing and fixing Water Meter DN-20	Each	1			
8		**Water Level Indicator**					
	N.s	Providing and fixing Water level indicator including the required electrical relay, complete in all respects and as per satisfaction of the Engineer Incharge.	Each	1			
		Total Amount Rs one Unit Cost for Govt Buildings				**-**	

Prepared By
(Quantity Surveyor)

Checked by
(Design Engineer)

Approved and Forwarded by
(General Manager)

ESTIMATE FOR MIS SYSTEM							
ENGINEER'S BOQ							
S. No.	**Ref No/ Item Code**	**Description of Items**	**Unit**	**Quantity**	**Unit Rate (Rs)**	**Total Amount (Rs)**	**Remarks**
MRS, 2nd BI-ANNUAL-2024 (01.07.2024 to 31.12.2024) MURREE							
1		**Water Monitoring System**					
	N S	Providing and fixing integration / water quality monitoring system at 35 household to be displayed at Urban Unit Muree Office with one computer , one large screen smart , two rain gauge , MIS system for integration and display Dash Board, Internet wiring, to display water quality in HHs tanks EC PH TDS and Water level tanks in Dash Board acceptable via net PC and Mobile. complete in all respect as per Engineer Incharge.					
i		3 Marla	Each	2			
ii		4 Marla	Each	2			
iii		5 Marla	Each	2			
iv		MC	Each	1			
v		Urban Unit Murree Office	Each	1			
Total Amount Rs one Unit Cost for MIS System						**-**	

PROJECT RAIN WATER
HARVESTING SYSTEM IN MURREE

SPECIFICATIONS OF PLUMBING WORKS

AUGUST, 2024

SECTION - 1

EXCAVATION, TRENCHING AND BACKFILLING

1.1 SCOPE

The work covered by this section of the Technical Specifications consists of furnishing all plant, labour, equipment, appliances, and the materials for performing all operations in connection with excavation, trenching and back-filling for water supply, sewerage and structures including all incidental works necessary for excavation to the required depth and dimensions in accordance with the applicable drawings, or as directed by the Engineer. The work shall be carried out in complete conformity with the specifications, setforth hereunder.

1.2 SETTING OUT

The Contractor shall set out the works in accordance with the dimensions, lines and levels shown on the Drawings. Where no precise positions or levels are shown on the drawings, the works shall be set out by the Contractor to the positions and levels determined by the Engineer's Representative as the work proceeds.

1.3 CLEARING AND GRUBBING

The sites of all excavations shall be cleared of all shrubs, plants, bushes, large roots, rubbish and other objectionable materials. All such materials shall be removed from site of work or otherwise disposed of at no extra cost in a manner satisfactory to the Engineer. All trees and shrubs that are designated by the Engineer to remain shall be adequately protected and preserved in an approved manner.

1.4 EXCAVATION

1.4.1 General

All excavation of whatever substance encountered shall be performed to the depths indicated or as otherwise specified. During excavation, material suitable for back-filling shall be stockpiled in an orderly manner at a sufficient distance from the banks of the excavation to avoid overloading and to prevent sides from caving. All excavated material unsuitable for backfill shall be removed and placed at a location approved by the Engineer. Grading shall be done as may be necessary to prevent surface water from flowing into the trenches or other excavations, and any water accumulated therein shall be removed by pumping or by other approved methods. Unless otherwise indicated or approved by the Engineer, excavation shall be open cut. For Contract purposes hereunder the

earth excavation work has been classified into two categories, earth excavation in trenches and earth excavation for structures.

1.4.2 Earth Excavation in Trenches

Unless otherwise directed or permitted by the Engineer not more than 100 ft of any trench in advance of the end of the pipeline already laid shall be opened at any time. Trenches shall be excavated to the dimensions and depths shown on the drawings or ordered by the Engineer or in such a position or to such dimensions and depths as shall allow for the proper construction of the relevant structure or proper excavation of the relevant operation. Pipe trenches shall be excavated to give a clear width of 6 inches on either side of the pipe. Additional excavation shall be carried out to give ample space for making joints and, where necessary, for concrete bedding or surround.

The banks of the pipe trench shall be as nearly vertical as practicable. Bell holes and depressions for joints shall be dug after the trench bottom has been prepared. The pipe, except for joints, shall rest on the prepared bottom for its full length. Bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joints. Stones shall be removed to avoid point bearing. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe as determined by the Engineer is encountered in the bottom of the trench, such material shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, or other suitable approved granular material. Such replacement of unsuitable material will be paid for at the contract unit price for that item of work as shall be agreed upon, before execution of this work, with the Engineer.

Where the Contractor has excavated to depths in excess of the requirements, from his neglect or from causes within his control, he shall refill and compact the excess excavation with suitable material approved by the Engineer, upto corrected level, at his own expense.

Excavation of appurtenances shall be sufficient to leave at least 12 inches but not more than 24 inches between the outer surface and the embankment or timber that may be used to hold and protect the banks. Any over-depth excavation below such appurtenances that has not been directed by the Engineer, will be considered un-authorized and shall be refilled with compacted sand, gravel or concrete, as directed by the Engineer and at no additional cost to the Employer.

1.4.3 Earth Excavation for Structures

All earth excavation under this contract, which is not included under the classification of "Earth excavation in Trenches" shall be classified and paid for as earth excavation for structures.

The Contractor shall provide adequate timbering or shoring for excavations,

should the sides and ends of any excavations give way the Contractor shall, at no extra cost, remove all disturbed ground. Any excavation carried outside the limits shown on drawings and specified herein as the payment limits, shall not be treated as excavated and shall not be paid for.

When foundation level or base of excavation is reached, the Engineer's representative will inspect the exposed ground and give directions as to what further excavation, if any, he considers necessary. The excavation should be done in such a manner, as to ensure that the work rests on a solid and perfectly clean foundation. If the Contractor allows any portion of such foundations to deteriorate due to exposure, he shall make good the foundation to the satisfaction of the Engineer without extra cost.

1.4.4 Replaced Soil under Foundations

1.4.4.1 Material

Selected well graded granular material shall be used for filling beneath the structural foundations. This material should meet the requirements of A-2-4 & A-3 (AASHTO soil classification).

The suitability of the material shall be supported by adequate tests in the laboratory.

1.4.4.2 Equipment and Procedure

Suitable equipment shall be selected by the Contractor on the basis of field trials for compaction. The contractor shall indicate his planning to carry out compaction in his Method Statement for Engineer's approval before undertaking actual compaction. A test section would be required to select the most suitable equipment, layer thickness, moisture content, No. of passes etc.

1.4.4.3 Compaction Standard

The contractor shall place the material to be compacted in layers. Each layer shall be of specified thickness and shall be compacted by the optimum number of passes as explained in above section. Compaction less than 75% of relative density or 95% of Modified Proctor Density shall not be acceptable.

1.4.4.4 Quality Control

Every compacted layer shall be tested for quality of compaction by performing in-situ density tests. Sand replacement method of density measurement shall be used. The evaluation of 75% relative density or 95% Modified Proctor Density shall be based on measurement of maximum, minimum and maximum Modified Proctor Densities in the laboratory. The frequency of this testing shall be instructed by the Engineer at the site.

1.5 PRECAUTIONARY AND REMEDIAL MEASURES

1.5.1 Protection of Existing Facilities and Structures

The Contractor shall take every necessary precaution not to endanger the safety, occupation or operation of any property, structures, installations or services in the vicinity of his operations and shall observe any restrictions imposed by the Authority concerned and the Engineer to this end. Should any such property, structures, installations or services be endangered or damaged as a result of the Contractor's operations, he shall immediately report any such danger or damage to the Engineer's Representative and any Authority concerned and shall forthwith undertake remedial measures to the satisfaction of the Engineer and the appropriate Authority with out additional cost.

1.5.2 Planking and Strutting

The Contractor shall provide at his own expense to the satisfaction of the Engineer all timbering, poling, shoring, strutting and other approved supports to the sides of all excavations, trenches and all other works in such a way as will be sufficient to secure them from falling and to prevent any movement. All responsibilities connected with this part of the work shall rest with the Contractor.

In removing timbering, shoring and strutting and all other supports from excavation and trenches, special care shall be taken to avoid pressure on fresh concrete or any other work until it is sufficiently safe to resist such pressure.

1.5.3 Dewatering

The Contractor shall build all drains and do ditching, pumping, well pointing, bailing, and all other work necessary to keep the excavation clear of ground water, sewage and storm water during the progress of the work and until the finished work is safe from injury. All water pumped or drained from the work shall be disposed of in a manner satisfactory to the Engineer and necessary precautions against flooding shall be taken. The procedure for dewatering of subsoil water from excavation for the purpose of construction of sewer lines and other structures shall be in accordance with the method given below:

- Dewatering of subsoil water from excavations of trenches and excavations for other structures shall be arranged by an adequate process of well-pointing, bailing and/or pumping or by any other suitable method approved by the Engineer on the basis of the method (statement to be submitted by the Contractor).

- If well-points are used then the following requirements shall be met with. Well-pointing shall consist of bore holes, provided with necessary strainers, blind pipes and pumping machinery, and these shall be of suitable size and depth and shall be located on both sides of the trench

and along the periphery of water level to a sufficient depth to keep the excavations clear of subsoil water during the process of construction.

- As a part of the work and at no extra cost, the Contractor shall provide all strainer pipes and other requisite material, and boring tools and plant, etc. for the well pointing and shall also provide pumping equipment as well as operating personnel, power, etc. Dewatering of subsoil water shall be continuous process round the clock during the progress of the work and until the finished work is safe, from injury to the complete satisfaction of the Engineer's representative and any interruption in continuous pumping and causing injury to the works done or under construction shall require the Contractor to repair or rebuild the works to the entire satisfaction of the Engineer's representative at no extra cost. No extra payment shall be made to the Contractor for the disposal of storm water and for dewatering in trenches and building structures less then 5 ft. depth.

1.5.4 Maintenance of Excavation

All excavation shall be properly maintained while open and exposed. Sufficient suitable barricades, warning lights, flood lights, reflective signs, and similar items shall be provided by the Contractor. The Contractor shall be responsible for any damage due to his negligence.

1.5.5 Surplus Materials

All surplus materials shall be disposed of at locations approved by the Engineer. The disposal of surplus material shall not interfere with other works and shall not damage or spoil other material. When it is necessary to haul earth or rock material over street or pavement, the Contractor shall prevent such material from falling on the street or pavement.

1.5.6 Cutting Pavement

In cutting or breaking street surfacing, the Contractor shall not use equipment which will damage the adjacent pavement. Existing paved surfaces shall be cut back beyond the edge of trenches to form neat square cuts. The road ballast, brick pavement, and other materials shall be placed on one side and shall be preserved for reinstatement when the trench is filled. Wherever necessary or required for the convenience of the public or individual residents, at street crossings and at private driveways, the Contractor shall provide suitable temporary bridges which shall be maintained in service until backfilling has been completed. The Contractor shall keep the road crossings manned 24 hours per day. During night time, enough red lights shall be provided to warn the traffic. If detour is necessary, the Contractor shall make proper detour for the traffic and shall install signs 3 ft. x 4 ft. in size indicating the detour.

1.6 TRANSPORTATION OF MATERIAL

All carts, trucks or other vehicles used by the Contractor for transportation of the material shall be suitably constructed or lined not to permit any leakage/spillage of soil while the vehicles are on the move. These would be so loaded and arranged as not to spill on the site and public roads. Whenever any vehicle so used is found leaking/spilling and unsuitable, it shall be immediately withdrawn from the work on notification by the Engineer.

1.7 COMPACTED FILL AND BACKFILL

1.7.1 General

After the completion of water and sewer lines, foundations, walls and other structures below the elevation of the final grade, all voids shall be backfilled with suitable materials, as specified below.

1.7.2 Backfilling for Structures

Backfilling operations for structures shall be performed as part of the Contractor's work under the payment items for earth excavation and at no extra cost to the Owner. It would comprise returning and filling the selected excavated material around foundations, and at back of walls etc., upto finished levels shown on the Drawings or as required in layers not exceeding 6 inches, carefully rammed and consolidated (with addition of water if required) so as to achieve a minimum relative density of 90% of modified proctor test at optimum moisture content. No fill shall be made until the concrete foundations and footings etc., have been inspected and approved by the Engineer. Earth to be used for filling must be free of all the organic impurities, debris or any other foreign matter. Earth which contains more than 1% of salts particularly sulphates will not be used in filling.

1.7.3 Backfilling of Trenches

The trenches shall not be completely backfilled until all required pressure tests are performed and until the water lines as installed conform to the requirements of specifications. Where in the opinion of the Engineer, damage is likely to result from withdrawing sheeting, shoring, the same shall be left in place and cut off at a level 1 ft. below ground surface. Sheeting left in place shall be paid for at the approved rate for that item of work. Trenches shall be backfilled to the ground surface with selected excavated material or other material that is suitable for proper compaction. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted to the specified density. The surface shall be restored to its original or better condition. Pavement and base course disturbed by trenching operations shall be replaced.

1.7.4 Lower Portion of Trench

Backfill material below and around pipe shall be deposited in 6 inch maximum thickness layers and compacted with suitable hand tampers to 90% of maximum density until there is a cover of not less than 1 ft. over the pipe. The backfill material in this portion of trench shall consist of sandy clay or other approved materials free from stones and lumps.

1.7.5 Remainder of Trench

The remainder of the trench portion above pipe shall be backfilled with material that is free from stones larger than 6 inch in any dimension. Backfill material shall be compacted to achieve a minimum relative density of 90% of modified proctor test at optimum moisture content for cohesive soils and 95 percent of maximum density for others.

1.8 BORROW

In case of insufficiency of excavated material and un-suitability of earth for backfilling, conforming to the above specifications, such material shall be brought from the source approved by the Engineer.

1.9 GRADING

After the completion of all backfilling operations, the Contractor shall grade the work areas to the lines, grades and elevations shown on the drawings or as directed by the Engineer. Finished grading shall not be done until the installation of all utilities or appurtenance. All damage due to settlement shall be repaired by and at the expense of the Contractor.

1.10 TESTING OF SOIL IN PLACE

The Engineer will make tests using the calibrated cone method/core cutter method to determine the density of soil in place. If soil in place fails to meet the specified degree of compaction the areas represented by the failing tests shall be removed, replaced and compacted to the specified density in the manner directed by the Engineer and at no additional cost to the Owner.

1.11 MEASUREMENT AND PAYMENT

1.11.1 Excavation and Backfilling

1.11.1.1 Method of Measurement

The measurement shall be made in cubic feet of earth acceptably excavated and backfilled for trenches and structures within the lines and grades shown on the drawing or as directed by the Engineer.

1.11.1.2 Basis of Payment

Payment for earth excavation and backfilling in trenches or structures will be made at the contract unit price per cubic ft.

The cost of dewatering, disposal of earth & earth & any shuttering or support required for excavation is included in the execution unit price.

Pay Item	D e s c r i p t i o n	Unit
1.1	Excavation for structures and compacted backfill including dewatering & disposal of surplus material.	Cft.
1.2	Excavation for trenches and compacted backfill including dewatering & disposal of surplus material.	Cft.

SECTION - 2

CONCRETE

2.1 SCOPE

This section covers the manufacture, forming, transporting, placing, stripping of forms, finishing and curing of plain and reinforced normal concrete in the structures included herein.

2.2 SPECIFICATIONS

Concrete work shall conform to all requirements of ACI 301-72, (Revised 1975), Specifications for Structural Concrete for Buildings, except as modified by supplemental requirements below. The Contractor shall submit, for the approval of the Engineer, before commencement of any work, his Method Statement which would provide complete details of the procedures and equipment to be used for the satisfactory execution of the work. The approval of such Method Statement shall not relieve the Contractor of any of his responsibilities under the Contract.

2.3 COMPOSITION AND QUALITY

Concrete shall be composed of Portland cement, water, fine and coarse aggregates and any admixtures as and when specified. The concrete mixes will be designed by the Engineer who will determine the required quality of the concrete for the structures covered by these Specifications. The desired strength of concrete for various parts of the structures have been shown on the Drawings. Such concrete mixes shall not relieve the Contractor of the responsibilities to the achieve the desired strength of concrete for various parts of structures as specified in the Technical Specifications or shown on the Drawing and to the full satisfaction of Engineer.

2.4 CEMENT

2.4.1 General

Cement shall be furnished in sacks or in bulk form as approved by the Engineer. Unless otherwise permitted, cement from not more than two plants shall be used and in general, the product from only one plant shall be used in any particular section of the work. No cement recovered through cleaning sacks shall be used.

2.4.2 Portland Cement

Portland cement shall be indigenous stuff unless otherwise approved by the Engineer. Portland cement shall conform to latest British Standard 12:1971, Specifications for Portland Cement or to ASTM Designation C150- 74, Standard Specifications for Portland Cement for Type I. Portland cement conforming to ASTM Designation C150-74, Type II or IV may also be used in certain parts of work as directed by the Engineer.

2.4.3 Tests

Cement shall be sampled at storage site and tested from time to time at the discretion of the Engineer in accordance with the ASTM Designation C150-74 or its equivalent British Standards. Expenses for such tests shall be borne by the Contractor. If the tests prove that the cement has become unsatisfactory, it shall be discarded and thrown as rejection as directed and to the full satisfaction of the Engineer. Cement which has been in storage at the project site longer than four months, shall not be used until retesting proves it to be satisfactory.

2.4.4 Storage

Cement shall be stored in dry, weather tight and properly ventilated structure. All storage facilities shall be subject to approval and shall be such as to permit easy access for inspection and identification of each consignment. Sufficient cement from a single source shall be in storage at the work site to complete any lift of concrete stored. Adequate storage capacity shall be furnished to provide sufficient cement to meet the peak needs of the project. Cement in sacks shall be stored on a damp proof floor and shall not be piled to a height exceeding 6 feet.

The Contractor shall use cement in the approximate chronological order in which it is received at the site. All empty sacks shall be promptly disposed of as permitted and directed by the Engineer so as to avoid any confusion in use of quantity of cement.

Cement storage facilities shall be emptied and cleaned by the Contractor when so directed, however the interval between required cleaning normally will not be less than four months.

Suitable, accurate scale shall be provided by the Contractor for weighing the cement in stores and elsewhere on the work, if required, and he shall also furnish all necessary test weights.

2.4.5 Delivery and Usage Record

Accurate records of receipts of cement at site and its use in the work shall be kept by the Contractor. Copies of these records shall be supplied to the Engineer in such a form as he may require.

2.5 AGGREGATES

Materials used as aggregates shall be obtained from sources known e.g Margalla/Shaheenabad/Sikhanwali to produce satisfactory results for the different classes of concrete. The use of aggregates from sources which have not been approved by the Engineer shall not be permitted.

2.5.1 Fine Aggregate for Concrete

Fine aggregate for all the classes of concrete shall be well graded natural sand, stone screenings or other inert material of similar characteristics or a combination of these. The whole of it shall be perfectly clean, free from coagulated lumps, soft and flaky particles, shale alkali, organic matter, loam mica and injurious amount of other deleterious substances. Maximum allowable content of silt and other deleterious inert substances is 5 percent by washing. Material derived from stone unsuitable for coarse aggregate shall not be used as fine aggregate. Fine aggregate derived from stone screenings shall be sharp, cubical, hard, dense and durable and shall be stacked on a platform so as to adequately protect it from dust and other admixtures.

Grading for the above specified fine aggregate shall be within the following limits, as determined by the Owner:

Sieve Size	**Percentage Passing (Dry Weight)**
3/8 inches	100
No. 4	95 to 100
No. 8	80 to 90
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	2 to 10

Fine aggregate for class D (1000 psi) concrete may be good quality bank run sand obtained from the River in vicinity. It shall be clean natural material graded from fine to coarse, free from lumps, clay, cinder, ashes, rubbish and other debris. It shall not contain more than 5 percent of material finer than No. 200 mesh screen, not more than 5 percent remaining on No. 4 sieve; all material shall pass through 3/8" screen.

2.5.2 Coarse Aggregate for Concrete

Coarse aggregate for the first 3 classes of concrete shall consist of quarried or crushed stone/river run gravel or inert material or a combination of these, with maximum size of 3/4 inch and shall be clean, hard durable, sound, cubical and well shaped, free from soft or friable matter, or thin elongated pieces, alkali, organic matter or injurious amounts of other deleterious substances. Deleterious inert matter shall not exceed 3 percent.

Grading for above specified coarse aggregate shall be within the following limits:

Sieve Size	**Percentage Passing (Dry Weight)**
1 inch	100
3/4inch	90 to 100
1/2 inch	20 to 55
3/8 inch	0 to 10
#-4	0 to 5

Coarse aggregates for Class D (1000 psi) concrete shall be broken stone or river run gravel from dense hard stone, or boulders. The stone or gravel should not be porous or slaty it must be free from earth, sand or other foreign matters. The broken aggregate or gravel shall be of the prescribed size for the class D (1000 psi). The broken aggregate or gravel shall be of max. size 1 inch or 1 1/2 inches and not contain any thing which will pass through No.4 sieve.

2.5.3 Storage of Aggregate

Each class of aggregate is to be stored separately and the Contractor is to provide means of ensuring that aggregates are stored on a suitable hard clean surface or platform to prevent contamination from the ground.

2.5.4 Proportions of Coarse and Fine Aggregates

The nominal ratio of the Volume of coarse aggregate to the volume of fine aggregate shall be decided by compression test of concrete cubes or cylinders to be furnished by the Contractor but the Owner may order these ratios to be varied slightly according to the grading of the aggregates by weight, if necessary, so as to produce required grading. Engineer can get the tests carried out at Contractor's cost.

At the beginning of the work and where there is any change in the coarse or fine aggregates or in their source of supply, the Contractor is to have a series of tests on cubes/cylinders made representative of and marked as to the aggregates and their grading and mix of concrete. Such cubes are to be tested in the laboratory under identical conditions, except for small variations in the relative

proportions of the coarse and fine aggregates up and down from the best proportions derived from the sieve analysis. The cubes etc. are to be tested at 7 days.

2.5.5 Water

Water for washing aggregates and for mixing and curing concrete shall be clean and free from injurious amounts of oil, acid, alkali, salt, organic matter, or other deleterious substances as determined by standard tests selected by the Engineer. It shall meet the following chemical requirements:

Chlorides such as sodium chloride	Max 3000ppm
Sulphates such as sodium sulphate	Max 2000ppm
Impurities	Max 2000ppm
Metled Salt	Max 25000ppm

The water for curing concrete should not have pH value lower than 5 and shall not contain impurities which cause discoloration of concrete.

2.6 CONCRETE MIX REQUIREMENTS

2.6.1 Strength

The concrete shall be one of four different classes to be paid for at their respective unit prices designated. The numerical classifications refer to the approximate proportions of cement, fine aggregate and coarse aggregate, according to the common practice. However, the actual concrete mix requirement shall consist of proportioning and mixing for the following strengths when tested in the form 6" cubes, 3 for 7 days and 3 for 28 days test shall be made for each class of concrete. The cubes are to be made, cured, stored, transported and tests are to be carried out at a testing laboratory approved by the Engineer. All such tests shall be at the cost of the Contractor.

Concrete Class	Cylinder (Min) Compressive Strength		Cube (Min) Compressive Strength	Tentative Ratio
	Tested at 7 days	Tested at 28 days	Tested at 28 days	
A:	2000 psi	3000 psi	4000 psi	1:1-1/2:3
B:	1600 psi	2400 psi	3000 psi	1:2:4
C:	1000 psi	1600 psi	2000 psi	1:3:6
D:	No strength requirements	800 psi	1000 psi	1:4:8

2.7 WATER CEMENT RATIO

The water-cement ratio is the ratio of the weight of water in the mix to the weight of cement therein. Water content shall be sufficient to produce a workable mix of the specified strength but the total water content shall be governed by the following table:

Concrete Class	Maximum Permissible Total Water Demand (Imperial) Gallons per 112 pounds of cement
A:	6.0
B:	7.5
C:	8.0
D:	No requirements

2.7.1 Consistency

Proportions of ingredients shall vary to achieve the desired concrete consistencies when tested, conforming to the following slump requirements or as desired by the Engineer:

Use of Concrete	Minimum and Maximum Slump (inch)
Normally reinforced sections compacted by vibration, hand compacted mass concrete.	1 to 3
Heavily reinforced concrete sections compacted by vibration, hand compacted concrete in normally rein-forced slabs, beams, columns and walls.	2 to 4

In all cases, the proportions of aggregates for concrete shall be such as to produce mixes which will work readily into the corners and angles of the forms and around the reinforcement without permitting the segregation of materials or liateance. Uniformity in concrete consisting from batch to batch shall be ensured.

2.8 MEASUREMENT OF MATERIALS

The coarse and fine aggregate are to be weighed or accurately measured to the Engineer's satisfaction. In no event they are to be measured by the shovel or barrow.

2.9 MIXING METHODS

The concrete shall be mixed in an approved mechanically operated batch mixer. The mixer, its hopper and working platforms shall be protected from rain and wind.

The aggregates and cement shall be mixed together before adding water until the concrete is of even colour and consistency throughout. Dirt and other undesirable substances shall be excluded. Water shall not be added indiscriminately from a hose or can. All concrete shall be thoroughly mixed by a modern reliable batch mixer to produce maximum output of concrete necessary to complete the work within the specified time without reducing the required mixing time. Concrete shall be mixed in the concrete mixers for the duration required for uniform distribution of the ingredients to produce a homogeneous mass of consistent colour but for not less than 1 1/2 minutes. The mixer shall be operated by trained operators, who have previous experience of running and operation of concrete mixers.

At the conclusion of mixing, the mixer and all handling plants shall be thoroughly cleaned out before the concrete remaining in them has had time to set.

No concrete shall be mixed by hand without the Engineer's written consent, and such consent shall be given only for small quantities under special circumstances.

2.10 TEST OF CONCRETE

2.10.1 Strength Test During the Work

Strength tests of the concrete placed during the course of the work will be made by the Engineer in an approved laboratory at the Contractor's expenses. The Contractor shall assist the Engineer in obtaining, for control purposes, such number of cylinders or cubes as the Engineer may direct, but in general, three beams taken from each 2650 cu.ft.or fraction thereof, or from each days pour, whichever is less, of each class of concrete placed, shall govern. Test specimen will be made and cured by the Engineer in accordance with the applicable requirement of ASTM Designation C31-69, Standard Method of Making and Curing Concrete Compressive and Flexural Test Specimens in the Field.

Cubes and beams will be tested by the Engineer in accordance with the applicable requirements of ASTM Designation C39-72, Standard Method of Test for Compressive Strength of Cubical Concrete Specimens and ASTM Designation C78-64, Standard Method of Test for Flexural Strength of concrete (Using Simple Beam with Third Point Loading). The test result will be based on the average of the strength of the test specimens except that if one specimen in a set of three shows manifest evidence of improper sampling, moulding, or testing, the test result will be based on the average of the remaining two specimens. If two specimens out of a set of three show such defects, the results of the set will be discarded and average strength determined from test results of the other two sets. The standard age of test will be 28 days, but 7 day tests may be used at the discretion of the Engineer, based on the relation between the 7 days and 28 days strengths of the concrete as established by tests for the materials and proportions used. If the average of the strength test of three specimen cured under laboratory controls, for any portion of the work, falls below the minimum allowable compressive or flexural strength at 28 days required for the class of concrete used in that portion, the Engineer may change the proportions of the constituents of the concrete, as necessary to secure the required strength for the remaining portions of the work. If the average strength of the specimens cured under actual field conditions as specified herein before falls below the minimum allowable strength, the Engineer will make such changes in the conditions for temperature and moisture under which the concrete work is being placed and cured as may be necessary to secure the required strength.

2.11 CONVEYING OF CONCRETE

Concrete shall be conveyed from mixer to the place of final deposit as rapidly as practicable, by methods which will prevent segregation or loss of ingredients and in accordance with latest edition of ACI Code Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.

Any wet batch hopper through which the concrete passes shall be conical in shape. There shall be no vertical drop greater than 5 ft. except where suitable equipment is provided to prevent segregation and where specifically authorized. Belt conveyers, chutes, or other similar equipment will not be permitted either for conveying concrete except where the use of such equipment is approved in writing by the Engineer, in advance of any use. Each type or class of concrete shall be visually identified by placing a coloured tag or marker on the bucket as it leaves the mixing plant so that the concrete may be positively identified and placed in the structure forms in the desired position.

2.12 PLACING

2.12.1 General

Concrete placing shall follow the Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete, latest ACI Code requirement. No

concrete shall be placed until all formwork, reinforcement, installation of parts to be embedded, bracing of forms and preparation of surface involved in the placing and the method of placement have been approved by the Engineer. Approval of the method of placement proposed will not relieve the Contractor of his responsibility for its adequacy and he shall remain solely responsible for the satisfactory construction of all work under the Contract.

Before concrete is placed, all surfaces upon or against which concrete is to be placed shall be free from standing water, mud, debris or loose material. All surfaces of form and embedded material that have become encrusted with dried mortar or grout from concrete previously placed shall be cleaned of all such mortar or grout before the surrounding or adjacent concrete is placed. The surfaces of absorptive material against or upon which concrete is to be placed shall be moistened thoroughly so that the moisture will not be drawn from the freshly placed concrete. Concrete shall be worked into the corners and angles of the forms and around all reinforcement and embedded items without permitting the materials to its final position in the forms. The depositing of concrete shall be regulated so that the concrete may be effectively compacted with a minimum of lateral movement into horizontal layers approximately 1.5 ft. in thickness. No concrete that has partially been hardened or contaminated by foreign materials shall be deposited in the structure, nor shall retampered concrete be used unless approved by the Engineer. The surfaces of construction joints shall be kept continuously wet for at least eighteen hours during the twenty four hours period prior to placing concrete except as otherwise directed by the Engineer. All free water shall be removed and the construction joint shall be completely surface dry prior to approval All concrete placing equipment and methods shall be subject to approval. Concrete placement will not be permitted, when in the opinion of the Engineer weather conditions prevent proper placement and consolidation.

2.13 COMPACTING CONCRETE

All concrete, except that in blinding layers and in- situ-concrete in very small sections, shall be compacted by vibration. After any necessary hand spading, working and ramming into place, each layer of concrete shall be compacted with mechanical immersion vibrators of types approved by the Engineer.

The immersion vibrators shall produce a vibration frequency of not less than 6000 impulses per minute. Under no circumstances shall the immersion vibrators be allowed to come into contact with reinforcement or shuttering. Immersion vibrators shall penetrate vertically for a few inches into any previous unset layer in order to establish a satisfactory bond, but no concrete shall be vibrated in such a manner as to cause injury to concrete (already set or otherwise) in other parts of works. Care shall be taken to keep the vibrators vertical, to insert them at regular intervals and withdraw them slowly to prevent the formation of voids, so that the entire mass of the concrete is properly compacted. Haphazard or random penetration of the vibrators without sufficient depth of insertion shall be avoided. A sufficient number of vibrators shall be

used to ensure compaction of each batch of concrete before the next batch is delivered. At least one extra vibrator shall be in hand for emergency use.

Vibration shall be supplemented by hand punning with approved small-diameter smooth steel rods with rounded ends in order to achieve complete compaction around reinforcement and other embedded fittings and a completely dense mortar finish against the shuttering.

Excessive vibration shall be avoided and vibration shall not be continued after a good surface finish, without free water, has been achieved. Vibration and punning shall be just sufficient to produce a dense, homogeneous concrete properly filling the moulds and free from air voids, segregation, bleeding, honey combing and other imperfections. Only highly skilled operators and workmen, subject to constant supervision, shall be employed in vibrating and punning concrete.

2.13.1 Time Interval between Mixing and Placing

Concrete mixed in stationary mixers and transported by non-agitating equipment shall be placed within thirty minutes after it has been mixed, unless otherwise authorized. When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within 1 1/2 hours after introduction of the cement to the aggregates. The concrete shall be placed within 20 minutes after it has been discharged. In all cases, concrete shall be placed and compacted well within the initial setting time.

2.14 CONCRETE FINISHES

Concrete fishes shall be made in accordance with the provision of ACI 301-8 or as directed by the Engineer

Workmanship in shuttering and concreting shall be such that concrete work shall normally require retouching and the surfaces being dense, watertight and where steel shuttering has been used, perfect and smooth. Should there be faults in these respects, the Contractor shall cut out and replace the whole of the lift concerned or such amount as the Engineer decides, or make good if permitted by the Engineer and to his approval. Concrete which is honey-combed or otherwise shows voids shall invariably be cut out and replaced in an approved manner as suggested by the Engineer.

Any making good shall be carried out immediately after striking the shuttering and shall be restricted to light rubbing down with wet carborundum or the approved correction of minor blemishes. In no circumstances shall surfaces be made good with cement or washes or rendering.

Exposed concrete surfacing not requiring shuttering and not subsequently to be given extra finishes shall be given perfectly dense smooth finish with a wooden float.

Where concrete slabs, ducts, bases or machine plinths will themselves form the finished floor surface the concrete shall be troweled immediately after the first laying process only just sufficiently to give a level surface. Thereafter, when the concrete has stiffened to a condition such that a hard compacted surface can be obtained without bringing up llaitance, a final surface troweling shall be given with a steel float to produce a smooth finish.

2.15 CONCRETE AND WEATHER

No concrete shall be placed when the atmospheric temperature is below 15 degree centigrade without the written permission of the Engineer. When directed by the Engineer the Contractor shall provide adequate means for maintaining a temperature of not less than 20 degree centigrade for 3 days or 15 degree centigrade for five days after placing the concrete.

If Rapid-Hardening Portland Cement is used, the period may be reduced as directed by the Engineer.

The Contractor shall supply such heating apparatus as stoves salamanders or steam equipment and the necessary fuel. When dry heat is used, means of maintaining atmospheric moisture shall be provided. All aggregates and mixing water shall be heated to temperature of at least 20 degree centigrade, but not more than 75 degree centigrade, the aggregates may be heated by either steam or dry heat, if permitted by the Engineer the torch method of heating mixed aggregate shall be such as to heat the mass uniformly and avoid spots which will burn the materials. The temperature of the concrete shall be not less than 10 degree centigrade at time of placing in the forms.

In case of extremely low temperature, the Engineer may, at his discretion, raise the minimum limiting temperature of water, aggregates and mixed concrete. When the shade temperature is above 32 degree centigrade, special precautions shall be observed during concreting to the satisfaction of the Engineer. Concreting will be permitted when it is not raining. Thermometer shall be kept at the Site by the Contractor.

2.16 CURING OF CONCRETE

Unless otherwise specified or ordered by the Engineer all concrete shall be cured by water. It shall be kept wet continuously for at least fourteen days after placement. It shall be covered with water saturated material like gunny bags, canvas, clean sand, matting, etc. or any other improved method duly approved by the Engineer.

In order that tensile stresses on the cooling of concrete shall be kept to a minimum, all materials shall be as cool as practicable when mixed and placed. To this end, aggregates shall be covered, coarse aggregates shall be cooled with water and mixing plant etc., water storage tanks and pipelines shall be covered or insulated from the effects of the sun. The temperature of concrete on placing shall in no case exceed 32 degree Centigrade.

Concrete shall be placed only against surfaces which are damp and no such work shall be started until arrangements for keeping the shuttering continuously cool and wet are in place. Shuttering and exposed faces of concrete and mortar shall be covered by at least 3 thicknesses of approved stout hessian kept continuously cool and wet by an efficient and comprehensive system of sprinklers and diffused jets of water, with appropriate temporary drainage arrangements, for at least 14 days after placing.

As an alternative to continuous curing with water after stripping of shuttering a proprietary membranes method of curing may be used provided that it is used strictly in accordance with the manufacturer's instructions, is coloured to show its presence, contains no bituminous substance, does not prejudice the appearance of permanently exposed concrete surfaces and is in all other respects to the approval of the Engineer. Wherever practicable, both faces of concrete structures shall be appropriately treated in order to prevent tensile stresses due to differential shrinkage or temperature across the section. Further more, the Contractor shall continue to provide facilities for covering and/or keeping wet such exposed surfaces of the Work as are, in the opinion of the Engineer liable at any time to be damaged by weather.

At no time shall any further work involving concrete proceed until the Contractor has satisfied the Engineer that all such work previously carried out is being protected and cured in accordance with this clause.

2.17 CONCRETE IN EXCAVATION AND FILLING

Before concrete is placed in or against any excavation or filling, the surface of such earthwork shall have been compacted and shall be free from running and standing water, oil and other deleterious matter. Loose earth and other material shall be removed. The excavation or filling shall be damp but not wet and special precautions shall be taken to prevent groundwater from damaging unset concrete or causing movement of the concrete.

Immediately after the excavation or filling has been trimmed and prepared as above, the exposed foundation shall be protected by a blinding layer or "No-fines" concrete or of cement mortar or other protection as shown on the Drawings or ordered by the Engineer. Such blinding layers and coatings shall be thoroughly cleaned and moistened before further concrete work is placed thereon.

Reinforced concrete shall not be cast against an unprotected face of earth or any other material liable to become loose or to slip; the greatest possible care shall be taken to avoid falls of material on to the concrete, by leaving the timbering in place (if permitted) or by removing the timbering in small depths and lengths at a time and by any other approved means. If any such falls occur, all soiled concrete shall be removed and replaced at Contractor's own cost.

2.18 SHUTTERING

The Contractor shall submit, for the approval of the Engineer full proposals and design calculations for all shuttering and proposals for the period of time to elapse before each item of the shuttering is struck. Not withstanding the approval of the Engineer to any actual shuttering or proposals for its striking, the Contractor shall retain complete responsibility for its adequacy as to the provisions of this clause and for any consequences of the striking being premature or harmful. In general the minimum time for the removal of form work shall be as under:

Form Work		Removal Time	Normal Weather above 15°C
a)	Form work of vertical surfaces such as Beams side walls and columns	4 days	2 days
b)	Slabs, props left under	10 days	5 days
c)	Props to slab	14 days	10 days
d)	Beam soffits, prop left under	14 days	7 days
c)	Removal of props to Beams	21 days	21 days

Shuttering shall be designed with easily sealed access hatches for inspection purposes and for removal of water and deleterious materials, and with connections to facilitate striking without damaging the concrete. Shuttering for soffits of slabs shall be erected with an upward camber of 1/4" for each 10 feet of span. When props are to be left in position under slabs the shuttering shall be made and removed in such a way that the props are not disturbed in any way.

A tolerance of plus or minus 1/8 inch in line or level will normally be permitted after erection of the shuttering which shall nevertheless be sufficiently strong, stiff and rigidly braced against loads due to the wet concrete and vibration and

against constructional loads, to remain true to the line and level accepted before concreting. It shall be sufficiently watertight to ensure that there shall occur no "fine" or escape of mortar at joints or of liquid from the concrete.

All exterior angles for concrete work not permanently burried in the ground shall be given 3/4" x 3/4" chamfers unless otherwise indicated on the Drawings.

Timber for shuttering shall be well seasoned, free from loose knots, splits, projecting nails and the like and from any adhering foreign matter.

Steel shuttering shall be used to produce a fair face concrete with only a faint but consistent pattern of plate marks on exposed concrete surfaces. The shuttering shall be assembled from wrought tongued and grooved boarding, true and tightly fitted with joints as necessary, the whole surface and all edges being rendered smooth before and after oiling. Bearing in mind the quality of the finish required, wrought, plain-edged and butt-joint boarding may replace the tongued and grooved boarding or purpose-made steel- faced shutters of first-class quality may be used, solely at the discretion of the Engineer.

Rough shuttering shall be used for surfaces to be buried in the ground and shall be assembled from sawn boards with smooth and true edges or from approved steel shutters. In either case all joints shall be suitably filled.

The inside faces of all shuttering shall be treated with an approved material to prevent adhesion of the concrete, all such materials being kept clear of the reinforcement and other items to be embedded.

Shuttering shall be struck by static force alone without shock and vibration causing any damage to the concrete. Shuttering being reused shall be thoroughly repaired and cleaned before re-assembly.

2.19 WATER STOPPER'S

2.19.1 Scope

The work to be done under this item consists of providing and installing PVC/Metal water stops as shown on the Drawings or as directed by the Engineer.

2.19.1 (a) Polyvinylchloride Water Stopper

Polivinylchloride waterstops shall be extruded from an elastomeric plastic compound, the basic resin of which shall be polyvinylechloride (PVC) The compound shall contain such additional resins, plasticizers, stabilizers or other materials needed to ensure that when the material is compounded and extruded to the shapes and dimensions shown, it will have physical characteristics when tested by the U.S. Corps of Engineers Tested Method specified below:

Physical Characteristics	No of Specimens Tested	Requirement	USCE Test Method
Tensile strength using die III, not less than	5	1750 psi	568
Ultimate elongation using die III, not less than	5	350%	573
Low temperature brittleness, no sign of failure such as cracking or chipping at	5	-35°F	570
Stiffness in flexure, 1/2 inch span, not less than	3	400 psi	571

Installation

The PVC Water stops shall be laid in continuous lengths. Splices in the continuity or at the intersections of runs of PVC water stops shall be performed by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations or as directed by the Engineer. A thermostatically controlled electric source of heat shall be used to make all splices. The correct temperature at which splices should be made will differ with the material used but should be sufficient to melt but not char the plastic. After splicing, a remolding iron with ribs and corrugations to match the pattern of the waterstop shall be used to reform the ribs at the splice. The continuity of the characteristic components of the cross section of the waterstop design (ribs, tubular center axis, protrusions, and the like) shall be maintained across the splice.

2.19.1 (b) Metal Waterstops

Copper, stainless steel and steel waterstops shall be installed in joints at the locations shown on the Drawings. The thickness, shape, dimensions and splicing of metal waterstops shall be as shown on the Drawings or as approved by the Engineer.

2.20 TERRAZZO WORK

2.20.1 Scope

The work to be done under this item consists of providing terrazzo finish inside the water tanks and at any other place shown on the Drawings. The subgrade shall comprise of (i) cement plaster (ii) cement concrete.

2.20.2 Material

Marble Chips of the specified grade, and colour shall be of approved quality obtained from quarries in Pakistan. Before any material is purchased, the Contractor shall submit to the Engineer for approved samples in duplicate. The material used in the work shall correspond with the approved samples, in quality, colour texture and finishes etc.

2.20.3 Subgrade

The subgrade under terrazzo top shall be 3000 psi cement concrete or1:2 cement sand plaster of the thickness specified on the Drawings. The subgrade shall be constructed in accordance with the applicable stipulations and requirements, Cement Plaster of the Specifications. The subgrade surface shall be kept wet for proper adhesion of terrazzo topping, which shall be laid when the subgrade has still not hardened.

2.20.4 Topping

Terrazzo top finishing of thickness as shown on the Drawings or the Finishing Schedule shall consist of marble chips and cement mixed in ratio of 1:2 (one part grey cement and 2 parts chips of approved grading and shade with admixture of approved pigment). Terrazzo topping shall be laid true to the pattern as given on the Drawings or as directed by the Engineer. The terrazzo topping shall be well compacted and all voids and dips made good.

2.20.5 Final Finish

Smooth Finish: After 48 hours of laying the terrazzo topping requiring smooth finishes shall be grinned with No.80 Carborundum stone until the marble chips are evenly exposed.

After the first grinding neat coat of suitably coloured cement slurry be applied to repair the pores if any, formed during the course of grinding and cured for 24 hours. The second and the third grinding shall be suitably carried out with grinding stone ranging from No. 80 to 240 respectively. Electric grinders shall be used to ensure that the grinding is adequate.

The surface after all chips have been evenly exposed will be cured for one week and left undisturbed for another week. After this period the surface shall be cleaned of dirt and dust by rubbing gently with pumice stone with sufficient water. If this treatment is not successful in removal of the white scum or other materials and hardened deposits, the floor shall be lightly rubbed with grinding stone while washing soda solution is being used. it would then be treated with oxalic acid (1:10) solution using felt or an old blanket. After oxalic acid treatment the surface shall be cleaned and washed with plenty of water and dried.

2.21 STEEL REINFORCEMENT

2.21.1 Scope

The work to be done under these items shall include furnish, cut, bend, and place all steel reinforcement as indicated on the Drawings or otherwise required. All reinforcement when surrounding concrete is placed shall be free from loose, flaky rust, and scale, and free from oil grease or other coating which might destroy or reduce its bond with the concrete. All placing shall be in accordance with Drawings furnished or approved. The use of reinforcement for the transmission of current for welding will not be permitted. All reinforcement, including dowels, remaining exposed in the work shall be suitably protected until embedded in concrete.

2.21.2 Cutting and Bending

Steel reinforcement may be mill or field cut and bent. All bending shall be in accordance with standard approved practice and by approved machine methods. When bending is required, it shall be performed prior to embedding the bars in the concrete. In all such cases, the bars shall be cold bent. Bending or straightening of bars partially embedded in set concrete shall not be permitted except in isolated cases where corrective action or a field change is required and is specifically approved by the Engineer.

2.21.3 Quality

Concrete reinforcement bars shall be of following quality:

Intermediate grade Steel: It shall be deformed bars conforming to ASTM 615-81(a,b) grade 40/ grade 60 or equivalent having a minimum yield strength of 40,000 psi/ 60,000 psi. The Contractor shall provide labour, materials, arrange measuring and testing facilities to ascertain quality, weight or quantity of steel at his own expense, No steel shall be incorporated in the Works without prior approval of the Engineer.

2.21.4 Spacing of Bars

The spacing of bars shall be as shown on the Drawings or as directed by the

Engineer. The variation from indicated spacing, provided that the total area of reinforcement is in accordance with the Drawings, shall not be more than 1 inch.

2.21.5 Relation of Bars to Concrete Surface

The cover of all main reinforcement shall conform to the dimensions shown on the Drawings. The protective covering shall not be less than, and shall not exceed more than 1/4" from the values specified on the Drawings, indicate the clear distance from the edge of the main reinforcement to the concrete surface. The concrete covering of stirrups spacer bars, and similar secondary reinforcement may be reduced by the diameter of such bars.

2.21.6 Splicing

Except as otherwise shown on the Drawings or specified herein, all splices, lengths of laps, splice locations, placement and embedment of reinforcement shall conform to the applicable requirements of American Concrete Institute 318-77, Building Code Requirements for Reinforced Concrete. All splices and locations of laps in reinforcement shall be as shown on the Drawings or as directed by the Engineer. Additional bar splices shall be provided as required, subject to approval of the Engineer. Lapped ends of bars may be placed in contact and securely wired or may be separated sufficiently to permit the embedment of the entire surface of each bars by butt-welding or by approved mechanical methods such as the Cadweld splice or other type splice using positive connectors shall be adopted where indicated or directed by the Engineer. Butt welding of reinforcing bars, where indicated or directed shall conform to the requirements of American Welding Society's Recommended Practice for Welding Reinforcing Steel, Metal Inserts and Connections, D.12.1. Concrete shall be protected from heat during welding operations.

2.21.7 Supports

All reinforcement shall be secured in place by use of metal or concrete supports, spacers, or ties, as approved by the Engineer. Such supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation. The supports shall be used in such a manner that they will discoloration or deterioration of the concrete. Concrete supports shall be manufactured of the same concrete mix as used in the structure to be concreted.

2.22 MEASUREMENT AND PAYMENT

Measurement and payment for concrete, reinforcement, precast concrete, PVC water stop and Terazzo/Mosaic work will be made in accordance with the provisions of this clause specified hereinafter.

2.22.1 Method of Measurement

Concrete will be measured for the number of cubic feet acceptably placed complete in all respects as per Drawings and in strict accordance with this section of specification.

Measurement for steel reinforcement will be made of number of Tons of reinforcing steel acceptably placed on the basis of the lengths of bars installed in accordance with the approved Drawings or bar schedules or as directed, converted to weight for the size of bars listed by the use of unit weights per linear foot as follows:

Bar Size	Unit Weight lbs. per foot
1/4"	0.167
3/8"	0.376
1/2"	0.668
5/8"	1.043
3/4"	1.502
7/8"	2.044
1"	2.670
1 1/8"	3.775
1 1/4"	4.172
1 3/8"	5.049

Steel in laps and embedments indicated on the Drawings or as required by the Engineer will be paid for at the steel unit price. No measurement for payment will be made for the steel consumed in providing supports and for the additional steel in laps which are authorised for the convenience of the Contractor.

Polyvinylechloride water stop of the size and gauge as shown on the Drawings will be measured for the number of linear feet acceptably placed in the work. In computing the quantities, no allowance will be made for laps.

Measurement for terrazzo/mosaic work will be made in square feet as shown on the Drawings.

2.22.2 Basis of Payment

Payment will be made in accordance with the unit prices in the Bill of Quantities for the various items in accordance with the specifications and shall constitute full compensation for furnishing all materials, shuttering, equipment and labour and for performing all operation necessary to complete the work.

BOQ Item	D e s c r i p t i o n	Unit
2.1	Provide and lay concrete	Cft.
2.2	Furnish and Fix Reinforcing Steel	Tons
2.3	Furnish and Install Water Stop	
	(i) PVC	Lft.
	(ii) Stainless Steel	Lft.
2.4	Provide and Lay Terrazzo/Mosaic Work	Sft.

SECTION - 3

BRICK AND CEMENT CONCRETE BLOCK WORK

3.1 SCOPE

This section consists of construction of brick/ cement concrete block work walls of any thickness with first class hand-mould and/or machine pressed bricks/cement concrete blocks with the specified ratio of cement mortar in foundation, plinth superstructure or for any other structure as directed by the Engineer, or shown in the Bid Schedule. The Contractor shall furnish all materials and all other requirements to produce finished brick/block work. Brick/block work and materials for brick/block work shall be in strict accordance with this section of the specifications and applicable drawings and subject to the terms and conditions of the Contract.

3.2 MATERIALS

3.2.1 Portland Cement

Portland cement shall conform to the stipulations and requirements set forth in Section "CONCRETE".

3.2.2 Mortar Sand

Sand for mortar used in construction of brickwork/blockwork required under these Specifications shall be furnished by the Contractor in accordance with the provisions and in conformity with the stipulations and requirements of ASTM Designation C144-70 or latest revision and shall have a fineness modulus between 1.6 to 2.5.

3.2.3 Water

The water used in the preparation of mortar shall be free from objectionable quantities of silt, organic matter, alkali salts and other impurities and it will be tested in accordance with BS-3148 and approved by the Engineer at the Contractor's cost.

3.2.4 Aggregate

Aggregates for mortar shall comply with the requirements of ASTM C144. Sand that has been in contact with seawater shall not be used unless it has been thoroughly washed to the satisfaction of the Engineer.

3.2.5 Additives

Additives where used, shall be proprietary products used in the proportions and manner recommended by the manufacturer. The additives shall in no way adversely affect the mortar strength or contain chemicals, which may e harmful to other building materials. To add gypsum to cement is strictly forbidden.

3.3 MORTAR AND GROUT

Materials for mortar, sand binding agent and water shall be mixed by volume for at least 3 minutes with the minimum amount of water to produce a correctly mixed mortar or grout of workable consistency in a mechanical batch mixer. For small jobs, hand mixing may be permitted, the ingredients being mixed with sufficient water to produce a correctly mixed workable mortar. Mortar used in masonry construction shall conform to ASTM C-270 standard.

Mortars shall be mixed in batches, which can be used within a period before the setting process commences. Once a mix begins drying off, it shall be rejected. No ingredients shall be added to it once the setting process has begun. Mortar shall not be retained for more than 30 minutes and shall be constantly worked over with hoe or shovel until used.

3.4 MORTAR BATCHING

Methods or equipment used for mixing mortar shall be such as will accurately determine and control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Engineer. If a mixer is used it shall be of approved design and the mixing time after the ingredients are in the mixer, except for the full amount of water, shall not be less than two minutes.

Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within 30 minutes after addition of water to the mix shall be wasted. Retampering of mortar shall not be allowed. Mixing pans and troughs shall be thoroughly cleaned and washed at the end of each day's work.

3.5 SCAFFOLDING

Contractor shall provide safe scaffolding of adequate strength for use of workmen at all levels and heights at his own expense. Scaffolding which is unsafe in the opinion of the Engineer shall not be used until it has strengthened and made safe for use of workmen. Cost of scaffolding etc., shall be included by the Contractor in the unit rate for masonry items.

Damage to masonry from scaffolding or from any other object shall be repaired by the Contractor at his own cost.

3.6. JOINTING

Jointing is the forming of joints as work proceeds. Joints shall be as follows:

3.6.1 Exterior exposed joints shall be tightly formed to a weather joint with the point of the trowel.

3.6.2 Interior exposed joints shall be tightly formed to a concave joints.

3.6.3 Joints which are subsequently covered with plaster or other finish materials shall be struck flush.

3.7 BRICKS

The bricks used shall be of standard size (9"x4.5"x3") first class well burnt, uniform in shape, size, texture, colour and should produce a ringing sound when struck. The bricks shall be free from flaws, cracks, chips, stone nodules of lime or kan-kar or any other blemishes. The brick shall not absorb more than one sixth of its weight when soaked in water for one hour. Compressive strength shall not be less than of 1400 psi. Bricks over burnt, under burnt vitrified and irregular shall not be used. Bricks of uniform size shall be used throughout the work and source of supply shall not be diversified.

3.7.1 Soaking

Before use all bricks shall be soaked in clean water in tanks or pits for at-least two hours.

3.7.2 Laying of Bricks

All brickwork shall be skillfully laid with level courses, uniform joints, square corners, plumb verticals and true surfaces except when otherwise shown on the Drawings or directed by the Engineer. Brickwork will be of best standard of workmanship obtainable and objectionable offsets in the brickwork shall be avoided. Smoothest practicable finished surface of the brickwork shall be ensured. Unless otherwise specified bricks shall be laid in English Bond with frogs (Manufacturer's marks) upward.

All horizontal joints shall be parallel and truly level. Vertical joints in alternate coarses shall come directly over one another. Thickness of joints unless otherwise specified shall not be less than 1/4 of an inch and not more than 3/8 of an inch. The height of 4 coarses and 3 joints as laid shall not exceed by more than 1 inch the height of 4 bricks as piled one upon the other.

3.7.3 Curing

All brick work involving use of cement shall be cured by water curing or other acceptable methods. The Engineer shall approve all methods and operations of the Contractor in curing different portions of work.

When curing by water brickwork shall be kept wet for at least 14 days by covering with water saturated materials or by a system of perforated pipes, mechanical sprinklers, porous hose, ponding or by any other approved method which will keep all surfaces to be cured continuously wet. Water used for curing shall meet the requirements given in Clause 3.2 of these specifications.

3.8 BLOCKS

Cement, aggregates and water for concrete blocks shall conform to the requirements as specified in the section for plain and reinforced concrete or as approved by the Engineer.

3.8.1 Concrete Block Making

3.8.1.1 The solid and hollow blocks as and where used by planning, shall be machine moulded. The block making machines shall be of the standard approved by the Engineer. They shall be operated according to the instructions laid down by the manufactures.

3.8.1.2 The blocks shall be continuously water cured by sprinkling water for a minimum of 10 days and covered between sprinkling operations with 4 mils thick polyethylene sheeting. After the 10 days water curing period the blocks shall be air dried. Under no circumstances will blocks be used in the work until they are completely dry. During curing period no surfaces of the block will be allowed to dry.

3.8.1.3 Cured concrete blocks shall be stored off the ground, stacked on level platforms, which allow air circulation under stacked units. Units shall be covered and protected against wetting.

3.8.1.4 Care shall be exercised in the handling of all concrete blocks. No damaged blocks shall be used in the work.

3.8.1.5 The blocks cast on different dates shall be stacked separately and must be labeled showing the date on which they were cast.

3.8.2 Properties of Blocks

3.8.2.1 All blocks shall be of size and shape required to complete the work shown in the Drawings or as instructed by the Engineer.

3.8.2.2 The cement, sand and coarse aggregate shall be volume batched and their proportion may be adjusted so as to provide the concrete of the required strength when tested and shall be mixed in a concrete mixer.

3.8.2.3 All blocks shall conform to ASTM C 145 standard. The compressive strength based on gross area shall be minimum 8.30 MPa for an average of 3 blocks and minimum 7.0 MPa for lowest individual blocks with 28 days after casting Cement Concrete Solid Blocks.

3.8.2.4 The Contractor shall provide test certificates show in the average minimum crushing strength of the blocks prior to the commencement of the construction. Further test certificates shall be provided as required by the Engineer, to ensure that all batches of block strengths are to be determined in accordance with ASTM C- 140 Standard.

3.8.2.5 The test shall be carried out by a laboratory approved by the Engineer. Evidence shall be produced that the block manufacturer has an efficient method of quality control. The Engineer will require to test samples of blocks periodically and the Contractor shall make necessary arrangements accordingly. The method of sampling for all test shall be in accordance with ASTM C-140.

3.8.2.6 All properties or specifications of blocks, not explain in these Specifications or ASTM C 145 shall comply with the requirements of PS 419, as directed by the Engineer.

3.8.3 Soluble Salt Content

For exposed block work, the contents by weight percent of soluble sulphate, calcium, magnesium, potassium and sodium radicals, shall not exceed 0.30, 0.10, 0.30, 0.03 percent respectively when ascertained in accordance with BS 3921, at the cost of the Contractor.

3.8.4 Erection

3.8.4.1 Block shall be laid true to line, level and laid in accurately spaced courses in stretcher bond with vertical joints of each course located at centre of units in alternate courses below. Vertical joints shall be buttered in the entire height of blocks. Each course shall be bonded. Courses of block shall be kept plumb throughout and corner reveals shall be true and in plumb.

Standard with of mortar joints for both horizontal and vertical joints shall be 7/16 inch (maximum). Mortar joints in wall shall have full mortar coverage on vertical and horizontal faces between the blocks. Mortar joints on wall including struck joints, shall be thoroughly compacted and pressed tight against the edges of the blocks with proper tools. Blocks terminating against soffits of beam or slab construction shall be wedged tight with wedges and the joints shall be packed solidly with mortar between the top of the block and the bottom of slab

or beam. Control expansion joints shall e kept free from mortar or other debris.

Unless otherwise shown on the drawings or specified by the Engineer, the spaces around door frames and other material or built in items shall be solidly filled with mortar. Spaces around the door and window hold fasts shall be filled in with Class C concrete. Work required to be built in with masonry including door frame anchors, wall plugs, dovetail anchors and accessories shall be built in as the erection progresses.

3.8.4.2 The block work shall be carried out in a uniform manner and no portion shall be carried more than one metre above the adjoining one at any times. All masonry shall be kept strictly true and square and the whole properly bonded together and levelled round each floor.

3.8.4.3 Sleeves, Chases, holes, sinking and mortices for other trades shall be correctly located and formed to the sizes as required by the relevant trades. Chiselling of completed walls or the formation of holes shall only be carried out with the approval of the Engineer.

3.8.4.4 Walls of blocks indicated as being non-load bearing shall be constructed on insitu concrete floor slab unit after the floor formwork is struck and the concrete has obtained sufficient strength to support their weight. Toothing into load-bearing walls shall not be permitted.

3.8.4.5 All bolts, anchors, ties, pipe sleeves, flushing metal attachments lintels and the like required to be built into the work shall be correctly inserted and executed as the work proceeds.

3.8.4.6 Walls or partitions abutting concrete columns or walls shall be securely anchored and tied with metal anchors or ties at not more than 18 inches vertical centres. Wall ties cast in with concrete shall be bent down after the removal of form work and shall be securely jointed into the mortar beds of walling.

3.8.5 Curing and Repairs

3.8.5.1 All block masonry shall be water cured and shall be kept wet for at least seven days, by an approved method, which will keep all surfaces to be cured continuously wet. Water used for curing shall meet the requirements of specifications for water used in the manufacture of blocks.

3.8.5.2 Tolerances

All block work shall be erected plumb and true to line and level with the maximum variation in any storey height or any length of wall being one mm in one metre. The maximum tolerance in the length, height or width of any single masonry wall shall be $\pm$ 1/8 inch.

3.8.5.3 If, after the completion of any block masonry work, the block is not in alignment or level, or does not, conform to the lines and grades shown on the Drawings or shows a defective surface, it shall be removed and replaced by the Contractor at his expense unless the Engineer grants permission, in writing, to patch or replace the defective area.

3.9 MEASUREMENT AND PAYMENT

3.9.1 Material (Brick and cement concrete block work)

Measurement and payment for brick/cement concrete block work shall be made in accordance with the provisions given hereafter.

3.9.1.1 Method of Measurement

Measurement for brick/block work shall include number of cubic ft. of brick/block work provided within the limits as shown on the Drawings or as directed by the Engineer.

3.9.1.2 Basis of Payment

Payment for brick/block work shall be made at the contract unit price per cubic feet. Payment shall constitute full compensation for furnishing all materials, equipment and labour including all incidentals necessary to complete the work:

Pay Item	D e s c r i p t i o n	Unit
3.1	Provide and Lay Brick Masonry with cement sand mortar in foundation and super structures.	Cft.
3.2	Provide and Lay Block Masonry with cement sand mortar in foundation and super structures.	Cft.

SECTION - 4

SURFACE RENDERING

4.1 SCOPE

The work covered by this part of the Specifications consists of supplying all materials, labour, equipment, appliances in performing all operations required for doing the work of cement plastering, pointing, and white washing in accordance with the herein stated requirements except when specifically modified by the Engineer.

4.2 CEMENT PLASTER

4.2.1 General

The work to be carried out under this item shall consist of providing 1/2" thick plaster in grey cement as specified below. The work shall be carried out in accordance with applicable requirements of British Code of practice 211:1966 or latest revision.

4.2.2 Materials

4.2.2.1 Cement

All cement required for incorporation in this Section shall conform to the applicable requirements of Section "CONCRETE"

4.2.2.2 Sand

The sand shall be of medium to coarse grain and having a fineness modulus varying between 1.10 to 1.50 obtained from an approved quarry e.g. Lawrencepur/Local. The material shall be free from clay, vegetable matters and other impurities. Sand bearing clay shall be washed at the discretion of the Engineer.

4.2.2.3 Water

Water required for cement sand paste and curing purposes shall conform to applicable requirements of Section "CONCRETE"

4.2.3 Mortar Composition

Mortar for plastering shall consist of one part of Portland cement to 3 parts of sand by volume.

4.2.4 Material Batching

Material batching for preparation of mortar shall conform to stipulations and requirements set for in the Section "BRICK AND CEMENT CONCRETE BLOCK WORK".

4.2.5 Application of Plaster

The surface on which plaster is to be applied shall in case of brick work, be properly raked and wetted before application of plaster. Plaster shall be applied in a thickness of 1/2". If the specified thickness sis more than 1/2" then plaster shall be applied in two coats viz rendering coat and the final coat. Plaster shall be carried out to the full length of the wall or to the natural points. Vertical or horizontal joints which show themselves shall not be allowed. Rendering coat shall be roughened with waving lines drawn by wire brushes to provide bond for the final coat and it shall be properly moistened before application of subsequent coat. The final coat shall be finished with floats to provide smooth and uniform surface. All arises shall be straight and either truly horizontal or perpendicular and finished with 1/8" radius. Defective finishes if any shall be cut out and re-plastered at the expense of the Contractor. Plaster after finishes shall be kept moist for about 10 days to the satisfaction of Engineer.

4.3 POINTING

4.3.1 Surface Preparation

The joints of brickwork which is to be pointed shall be raked out with a hook to a depth of 1/2". The raking shall be done while the mortar is still green and not later than 48 hours of time of laying. After raking, the brick work is brushed to remove all loose dust from the joints and thoroughly washed with water, all putlog holes shall be filled up before pointing as the scaffolding for masonry has been taken down. The work shall be watered for 24 hours before pointing is done.

4.3.2 Materials

4.3.2.1 Cement

All cement required for incorporation in this section shall conform to the applicable requirements of Section "CONCRETE".

4.3.2.2 Sand

The sand required for incorporation in this Section shall conform to the applicable requirements of "CEMENT PLASTER" as per Clause 4.2.

4.3.2.3 Water

Water required for cement sand paste and curing purposes shall conform to applicable requirements of Section "CONCRETE".

4.3.3 Mortar Composition

Unless otherwise specified, the mortar shall be mixed by volume. The ratio of Cement Sand shall be as specified in the BOQ.

4.3.4 Material Batching

Material batching for preparation of mortar shall conform to stipulations and requirements set forth in Section "BRICK WORK".

4.3.5 Precautions

Before starting work of pointing the following precautions shall be taken.

i) Fine aggregate i.e. sand shall be washed before use.

ii) It shall be ensured that all joints are properly raked.

iii) The surface to be pointed shall be kept moist but excessive moisture shall be avoided.

iv) The scaffolding for pointing shall always be provided double.

4.3.6 Type of Pointing

Unless otherwise specified, the following types of pointing shall be done.

4.3.6.1 Deep or Struck Cement Pointing

This type of pointing shall be done to all un-plastered faces of brickwork where the brickwork is liable to be affected by dampness and saltpeter, such as in the plinths of buildings. The mortar shall be filled in the joints flush with masonry or brickwork with a pointing trowel and then pressed with proper pointing tools. Lining with a spike on a mass of mortar shall not be allowed.

4.3.6.2 Flush Cement Pointing

This type of pointing shall be done at all brickwork with exposed face, when `the finish of the face is not important or when a flush floor surface is required or when the floor or brickwork is subject to wear or to the effects of dampness and saltpeter. The mortar shall be filled and pressed into the joints with a jointing trowel, and finished off level with the edges of the bricks to give the smoothest

possible appearance to the work.

4.3.7 Pointing Tools

The pointing tools for horizontal joint shall be such as to form weathered and struck joints; and for vertical joint, triangles, so as to make a (v) notch. Care shall be taken not to develop a cutting edge in the tools since the idea is to compress the green mortar into the joints and not to cut it away.

4.3.8 Edges of Bricks

The mortar shall not be spread irregularly over the edges and corners of the bricks which shall be left clearly visible. The practice of smearing mortar over defects in bricks, to hide them shall not be allowed and shall render the whole brickwork liable to be rejected.

4.3.9 Washing after Pointing

After pointing, the face of the work shall be cleared off all surplus mortar sticking to the face. No washing shall be done till the pointing has set.

4.3.10 Protection during curing.

After completion, pointing shall be kept for 10 days and shall be protected during that period from extreme fluctuations of temperature and weather

All defects detected during curing or afterwards shall be treated at the Contractor's expenses according to directions of the Engineer.

4.4 PAINTING

The following codes and standards shall be followed wherever relevant and applicable and/or directed by the Engineer.

BS 242-66	Linseed Oil.
BS 245-76	Specification for mineral solvents (white spirit and related hydrocarbon solvents) for paints and other purposes.
BS 2523-83	Lead-based priming paint
BS 2569-64/45	Sprayed metal coatings.
BS 2992-70	Painters and decorators brushes.
BS CP. 3012-72	Cleaning and preparation of metal surfaces.
BS 4800-81	Paint colours for building pruposes.
BS 5082-74	Water-thinned priming paints for wood.
BS 5358-76	Specifications for low-lead solvent-thinned priming paint for woodwork.
BS 6150-82	Code of practice for painting of buildings.

4.4.1 White or Colour Washing

The whitewash shall be made from pure fat lime brought to site of work in the form of un- slaked lime. Water shall be added to this lime in a container until the mixture is of consistency cream and allowed to rest until cracks shall appear on its surface (48-72 hours). After screening through coarse cloth, gum at the rate of 4 oz. boiled with 10 oz. of rice shall be added to each cubic feet of white wash. The colour pigment if required shall be added and mixed with white wash and stirred to give the required shade. Enough quantity shall be prepared in one go so as to meet the requirement of one complete room.

4.4.2 Weather Resistant Paint

4.4.2.1 Selection of Paints

Concrete and Masonry

Cement based paints or one of the three common types of the exterior latex paints (polyvinyl acetate, styrene-butadiene and acrylic) of ICI/Burger make or equivalent shall be used whichever specified. Approved quality cement based or weather resistant emulsion paints shall be used as directed by the Engineer.

4.4.2.2 Primers

Concrete and Masonry

Boiled linseed oil or silicone water repellent primers ICI/Burger make or equivalent shall be used on concrete and masonry surfaces. Before application of paint, concrete and masonry surface should be allowed to dry for at least 3 weeks after cessation of curing.

4.4.2.3 Fillers

Concrete and Masonry

Paste of zinc oxide and varnish thinned with turpentine shall be used as filler on masonry and concrete.

4.4.2.4 Sealers

Concrete and Masonry

Water-insoluble and water-repellent substances dissolved in solvent such as petroleum naphtha or the special clear silicone compounds shall be used to seal masonry surfaces.

4.4.2.5 Thinners

Concrete and Masonry

Thinners such as turpentine, mineral spirit, water, xylene and linseed oil of approved quality shall only be used in accordance with the manufacturers' instructions and with prior approval of the engineer.

4.4.2.6 Brushes

All brushes used for painting work shall conform to B.S 2992 or equivalent American Standards.

4.4.3 Preparation of Surface

All loose material and dirt on the surface shall be removed with a brush. Holes and irregularities of surface shall be repaired with lime putty, and the surface shall be allowed to dry before applying whitewash or colour wash and weather resistant paint. All greasy spots shall be given a coat of rice, water and sand. Surfaces discolored by smoke shall be washed with a mixture of wood ashes and water or yellow earth before being white-washed or painted.

4.4.4 Application

Three coats of white or colour wash shall be applied on the prepared surface with a brush. Paint or finish to any surface shall be applied when ambient temperature is 10 degree centigrade or above and less than 43 degree centigrade unless other wise recommended by the manufacturer. No painting shall be done above 90% relative humidity. Drop cloths shall be placed to adequately protect all finished work.

All paint and coating materials shall be in thoroughly mixed condition at the time of application. All work shall be done in a workman-like manner, leaving the finished surface free from drips, ridges, waves, laps and brush marks. All paints shall be applied under dry and dust free conditions.

All primary paint shall be applied by brushing. The first coat of paint shall be applied immediately after cleaning.

4.5 MEASUREMENT AND PAYMENT

4.5.1 Cement Plaster

Measurement and payment for cement plaster shall be made in accordance with the provisions given hereafter.

4.5.1.1 Method of Measurement

Measurement shall be made of cement plastering for the actual area in square foot in accordance with this section of Specification or as directed by the Engineer.

4.5.1.2 Basis of Payment

Payment shall be made for the number of square foot of surface area cement plastered at the contract unit price per square foot and shall constitute full compensation for furnishing all materials, equipment and labour including all incidentals necessary to complete the work in strict accordance with this Section of Specification.

Pay Item	Description	Unit
4-1	Provide and apply ½" thick 1:3 Cement Sand Plaster for ceiling.	Sq.ft.
4-2	Provide and apply ½" thick 1:4 Cement Sand Plaster for walls.	Sq.ft.

4.5.2 Pointing

Measurement and payment for cement pointing shall be made in accordance with the provisions given hereafter.

4.5.2.1 Method of Measurement

Measurement will be made of cement pointing for the actual area in sq.ft in accordance with this section of Specification or as directed by the Engineer.

4.5.2.2 Basis of Payment

Payment shall be made for the number of square feet of surface area cement pointed at the contract unit price per square feet and shall constitute full compensation for furnishing all materials, equipment and labour including all incidentals necessary to complete the work in strict accordance with this section of specification.

Pay Item	Description	Unit
4-3	Provide and apply Cement Sand mortar	
	i) Flush pointing	Sq.ft
	ii) Struck pointing	Sq.ft

4.5.3 Painting

Measurement and payment for white washing and weather resistant paint shall be made in accordance with the provisions given hereafter.

4.5.3.1 Method of Measurement

The measurement shall be made in sq.ft of the actual surfaces completed and approved.

4.5.3.2 Basis of Payment

Payment shall be made for number of square feet of the actual surface painted measured as provided above at the Contract unit price per square feet for the respective item and shall constitute full compensation for all materials, equipment, labour, including all incidentals necessary to complete the work.

Pay Item	Description	Unit
4.3	Provide and apply white wash.	Sq.ft.
4.4	Provide and apply weather resistant paint.	Sq.ft.
4.3	Provide and apply vinyl emulsion paint.	Sq.ft.
4.4	Provide and apply enamel paint.	Sq.ft.

SECTION - 6

ROOF INSULATION

6.1 SCOPE

The work consists of insulation with brick tiles of sizes 9"x4" x 1 1/2" or any other approved size laid in cement mortar (1:3) over rammed mud laid to grade as shown on drawings after applying two coats of bitumen on the R.C.C. roof slab surface at 30/25 lbs, respectively for first and second coats at specified heat and laying 20 lbs. polythene sheet complete in all respects.

6.2 MATERIALS

The brick tiles shall comply with the standards set in "Section Bricks" except for their thickness and strength. The cement, sand and water shall meet the requirements as given in Section "CONCRETE".

Bitumen shall be PB3 or PB4

The clay for making mud shall be clean, free of all organic and other injurious matters.

6.3 APPLICATION

6.3.1 Bitumen Painting

Bitumen heated to the specified temperature and applied on R.C.C. roof slab cleaned and dried surface including sanding at 1 1/2 cu.ft per hundred sq.ft. of surface.

6.3.2 Laying Mud

The clay shall be mixed with reasonable quantity of water and thoroughly kneaded to form a thick paste to which copped straw at the rate of 10 lbs. per cu.ft of mud shall be added. It shall be laid and thumped with wooden trowels to form the slope as shown on the drawings.

6.3.3 Laying of Tiles

The brick tiles shall be laid in cement mortar (1:3) in fall/slope as shown on drawings.

6.3.4 Pointing

The brick tiles shall then be flush pointed in cement mortar (1:2)

6.3.5 Curing

The tiles laid shall be cured properly for ten days.

6.4 MEASUREMENT AND PAYMENT

6.4.1 Roof Insulation

Measurement and payment for roof insulation shall be made in accordance with the provisions given hereafter.

6.4.1.1 Method of Measurement

The measurement of the roof insulation shall be made in actual area acceptably laid in square feet complete in all respects as per relevant drawing or as directed by the Engineer.

6.4.1.2 Basis of Payment

Payment for roof insulation work shall be made for the number of the sq.ft measured of roof insulation provided above at the Contract Unit Price per sq.ft. It includes the cost of bitumen, mud laying, laying of tiles & pointing and shall constitute full compensation for providing and furnishing all materials, equipment, labour and all incidentals necessary to complete the work in accordance wit the specifications for B.O.Q. items.

Pay Item	D e s c r i p t i o n	Unit
6.1	Provide and Lay Roof insulation earth and tile roofing as per drawing	Sft.

SECTION - 7

FLOORING

7.1 SCOPE

The work covered in this Section consists of furnishing all plant, labour and material etc., and of performing all operations in connection with making cement concrete floor in conformity with lines and dimensions shown on the Drawings and in strict accordance with these specifications.

7.2 MATERIALS

Cement, sand and aggregate shall conform to the requirement of relevant clauses in section "CONCRETE"

7.3 BASE FOR FLOORING

The base for flooring shall be laid down when the earth filling has been done up to the specified level in a layer of 6 inches and has been properly watered and consolidated and correctly leveled.

A layer of sand about 4" thick shall be laid and rammed after having saturated so that a 4" layer is reduced to about 3" after compaction.

Portland cement concrete of Class C (2000 psi) shall be laid in one operation in a uniform layer of specified thickness, absolutely true and parallel to the required level of the finished surface. Concrete shall be cured for at least 7 days before any topping is laid. Before laying the surface shall be washed and scrubbed with wire brushes so that the concrete in the base and the topping are well bounded.

7.4 CEMENT CONCRETE FLOORING

Before laying the topping, the surface of the base shall be divided into symmetrical panels by glass strips. The size of panels, unless otherwise specified, shall not exceed 3 ft. square and concrete shall be placed in alternative panels. The top of the glass strips shall be adjusted to the specified level of the finished floor surface.

Cement concrete floor shall consist of laying a topping of cement concrete of Class B (3000 psi) of specified thickness over the prepared and finished base as or roughed surface of floor slabs.

Placing operation shall be specifically timed. No sooner the concrete has been evenly spread in a panel, then it shall be beaten for about 5 to 10 minutes with "wooden thapies" (about 5 lbs. weight).

Immediately after consolidation, the surface shall be leveled with a wooden trowel. Excessive trowelling in the early stages shall be avoided. The surface shall be tested with a straight edge to detect undulations, which, if found, shall be eliminated. The finer stuff in the concrete which has come to the surface with the stroking shall be quickly but carefully smoothen with the steel trowel. When the concrete has hardened sufficiently, trowelling shall be done with steel trowel. No dry cement or a mixture of dry cement shall be sprinkled on the surface for hardening the surface.

7.5 BRICK FLOORING

The work covered by this item consists of furnishing and laying 4 inch sand over prepared earth to required slope and grade. 3 inch thick layer of Class D (1000 psi) concrete is laid over it and 4.5 inch thick brick on edge are laid in 1:3 cement sand mortar. These joints of these bricks are struck at the top by flush pointing.

7.5.1 Method of Construction

The method consists of placing bricks on edge for flooring in 1:3 cement sand mortar over 4 inch sand and 3inch Class D (1000 psi) concrete and striking the joints of bricks with flush pointing and laid over thoroughly consolidated bottom by ramming and watering before laying this floor.

7.6 CURING

The concrete flooring properly laid shall be cured for 7 days.

7.7 MEASUREMENT AND PAYMENT

7.7.1 Flooring Material

Measurement and payment for concrete flooring, brick flooring and compacted sand fill will be made in accordance with the provisions given hereafter.

7.7.1.1 Method of Measurement

Measurement will be made for the number of square feet of flooring acceptably placed complete in all respects as per drawings and in strict accordance with this section of specification or as directed by the Engineer.

7.7.1.2 Basis of Payment

Payment will be made for the number of square feet of flooring measured as above at the Contract Unit Price per square feet and shall constitute full compensation for all work including earth and sand filling, glass strips, concrete, brick on edge and all other incidentals to complete the work.

Pay Item	D e s c r i p t i o n	Unit
7.1	Provide and Lay compacted 3" sand fill and Cement Concrete Floors using 1/4" thick glass strips for panel.	Sft.
7.2	Provide and Lay compacted 4" sand fill and brick on edge flooring laid over 3 inch thick glass class D concrete.	Sft.
7.3	Provide and Lay dry brick or stone ballast 1-1/2” to 2” gauge under floor.	Cft.
7.4	Provide and Lay PCC class B (300 psi) floor 1-1/2” thick in ground floor laid over dry brick.	Sft
7.4	Provide and Lay floors of 1 inch thick floor of chip tile 12” x 12” x 1” in grey cement over 1” cement mortar 1:4.	Sft

…….

SECTION - 8

METAL WORKS

8.1 SCOPE

This Section of specification consists of furnishing all plant, labour, equipment and materials in performing all operations in connection with providing and fixing metal works such as shutter, brackets etc. All metal gutters including painting shall be according to the Schedule specified on drawings and manufactured by a firm to be approved by the Engineer. They shall be handled with care, shall be staked on edge on level bearers and be supported evenly against a wall or vertical bearers, under cover.

8.2 CONTRACTOR TO FIX

The Contractor shall fix the windows, doors & rolling shutters as described. He shall be responsible for storing windows etc., and carrying to their respective positions, assembling composites, bedding and jointing with Matic at the mullions and transoms, fixing lugs and screws to frames, placing in the openings and bedding with cement and pointing externally with mastic.

8.3 BUILDING IN

Where applicable metal gutters etc., shall be built in, set to designed slope and geometry. When screwing up lugs or fixing screws, care shall be taken to ensure that shape etc. are not distorted.

8.4 FIXING INTO PREPARED OPENINGS

Gutters etc., to be fixed into prepared slope and alignments and have at least 1/8 inch tolerance all round. Supporting frames shall be chalked with mastic cement of an approved make.

8.5 FABRICATION OF GUTTERS

Shape:

The steel section shall be thoroughly straightened in the shape by methods that will not injure it before being laid off or worked in any way.

Cutting and Forming:

All members shall be so cut and formed that they can be accurately assembled without being unduly cracked strained or forced into position.

Jointing:

The jointing of the different parts of the members of mild steel shall be carried out by welding process in conformity with the requirements of American Welding Society for such joints. Welding points shall be made quite smooth by filling them and making smooth.

Galvanizing:

If required all exterior doors, frames, anchors, reinforcing and related items shall be fabricated from hot dipped galvanized steel, conforming to BS 729 Part 1. Following fabrication, touch up all welds with liquid Zinc. Window frames and ventilators shall be hot dipped galvanized after fabrication conforming to BS 729 Part 1. Following fabrication, touch up all welds with liquid Zinc.

8.6 PUTTY

The putty shall be of a type specially prepared for use with metal work in tropical conditions.

8.7 PROTECTION OF FITTINGS

Fittings shall be wrapped and protected from damage until all rough trades have been completed.

8.8 FABRICATION OF ROLLING SHUTTERS

8.8.1 Gutter

The gutter shall be fabricated using standard galvanized corrugated segments of the required length according to size of the shutter and of 20 gauge thickness. These segments shall be inter linked properly to allow rotation for smooth rolling up and down.

8.8.2 Supporting Frame for Gutter

The supporting frame shall be of standard mild steel. Steel section strong enough to support the load of the gutter with minimum deflection. This support shall have adequate supports at the ends fabricated from mild steel plates. Gutter shall have bracket supports at regular interval based upon the actual site conditions. However, due to space limitation for mounting, the same may be adjusted as per site conditions.

8.8.6 Cover

The cover shall be fabricated from 22 SWG gauge mild steel sheet of uniform shape and size without deformations.

8.10 PAINTING PREPARATION OF THE METAL WORK

Iron and steel surfaces shall be cleaned by means of solvents approved methods. Cleaned surfaces shall be primed as soon as practicable after cleaning.

8.11 PAINT APPLICATION

Unless otherwise specified or instructed the Contractor shall apply paints as follows:

8.11.1 Internal Surfaces of Steel Work

2 coats Zinc Chrome primer
2 under coats
1 glass finish coat

8.11.2 External Surfaces of Steel Work

2 Coats Zinc Chrome Primer
1 aluminium bitumastic under coat
1 aluminium bitumastic finish coat.

All painting coats upto and including the first undercoats, shall be applied under cover at "WORKS" before dispatch to the Site. (The second undercoat and the finishing coat shall be applied after erection on Site). Extreme care shall be taken to protect paint coats during transit.

8.12 PAINT

The paints for any painting sequence shall be mutually compatible and of the same approved manufacture. All paints shall be supplied in small sealed containers each not exceeding one gallon capacity.

8.13 WIRE GAUGE

Unless otherwise specified the wire gauze shall be of best quality as approved by the Engineer uniformly woven wire webbing of 12 x 12 meshes to 645 mm (one sq.inch) made from 22 gauge galvanized iron wire. All panel shall be in one piece and no joints shall be allowed in the gauge.

Wire gauge shall be fixed as shown on the drawings or as directed by the Engineer. The gauze shall remain right to the full width and without any sag.

8.14 MEASUREMENT AND PAYMENT

8.14.1 Gutters

Measurement and payment for steel gutters shall be in accordance with the provisions given hereafter.

8.14.1.1 Method of Measurement

The quantity to be paid for under this item shall be paid as per the actual length covered along slopy roofs complete in all respects as per relevant drawings or as directed by the Engineer.

8.14.1.2 Basis of Payment

Payment shall be made for the actual linear length of the steel gutters doors, as provided above at the Contract Unit Price per RFT. for all supply of items and means of fixing, cutting, shaping, priming, painting as necessary and all other operations required for the complete erection and commissioning to the full satisfaction of the Engineer for the item:

Pay Item	D e s c r i p t i o n	Unit
8.1	Provide, Install and paint Complete Steel gutter, brackets, painting etc.	Rft.

SECTION - 16

MISCELLANEOUS

16.1 SCOPE

The work covered by this section of the specifications consists of furnishing all plants, labour, equipment and materials and of performing all operations in connection with the miscellaneous items in strict accordance with this section of the specifications and the applicable drawings or as directed by the Engineer.

16.2 MATERIALS AND CONSTRUCTION

16.2.1 Steel Work

Structural steel work shall comply in all respects with B.S. 449. Steel for rolled sections shall comply in all respects with B.S. 16. Welding of steel work shall comply with B.S. 1856. High strength bolted connection shall comply with B.S. 3294.

16.2.2 Steel Ladder/Stairs

Steel access ladders shall comply with B.S 4211 unless otherwise stated. Stringers shall be rectangular section measuring 2-1/2 inches by 1/2 inches spaced 15 inches apart and rungs shall be 3/4 inch diameter spaced at 12 inches centre. Hoops shall be of circular pattern and shall be bolted to the stringers so as to be removable. Ladders shall be painted with black enamel paint of an approved make.

Steel stairs shall be as shown on the Drawings or as directed by the Engineer.

16.2.3 Brick Pavement

Bricks for pavement in the water works areas shall comply with the requirements of Section-3 of the technical specifications. Excavation and compacted backfill shall be in accordance with the requirements of Section-1 of the Technical Specifications. Bricks joints shall be sand grouted. Pavement shall be constructed in accordance with the Drawings or as directed by the Engineer.

16.2.4 Level Indicator

Level indicators shall be installed in accordance with the applicable drawings and as directed by the Engineer. The contractor shall be responsible for manufacturing and fixing of all components involved to make it a complete working unit.

16.2.5 Lightening Arrester

Lightening Arrester including all associated copper strip shall be installed strictly in accordance with the applicable drawings and as directed by the Engineer. The Contractor shall be responsible for providing and fixing all copper strips and other components to make it a complete working unit.

16.2.6 Water Storage Tank

1) The water tanks must comply with Pakistan Standards and Quality Control Authority (PSQCA) specifications for plastic storage tanks (PS: 4991-2004) and be made from virgin, food-grade polyethylene, UV-stabilized to prevent degradation. The tanks, with capacities ranging from 1000 liters to 4000 liters, must be rotomolded in a single piece with uniform wall thickness and free from defects.

2) They should have a cylindrical, vertical design with a domed top and flat bottom, a tightly fitting lockable lid, at least one inlet and one outlet with threaded connections, a vent or overflow outlet, and provision for a level indicator. The tanks must also have a designated area for affixing a custom monogram or logo sticker as specified by the client.

3) Each tank must withstand hydrostatic pressure without deformation and be leak-proof, certified for storing potable water, and come with documentation proving compliance with food-grade standards. Each tank must have a RFID chip embedded/embossed and should clearly display a QR code, which when scanned, provides information about the project and safe water use practices for potable and non-potable rainwater usage applications and other education material.

4) Reputable manufacturers like Dura or Popular should supply the tanks, which must have a minimum 5-year warranty against manufacturing defects. Clear installation and maintenance instructions, along with labels indicating the manufacturer's name, capacity, material grade, and date of manufacture, must be included. Suppliers must provide compliance certificates, technical datasheets, and warranty documents with the delivery. Reference image of the tank with logo is attached in the section below.

16.2.7 Toilet Fixtures and Plumbing Works

Toilet fixtures and plumbing works as approved by the Engineer shall be fixed according to standard drawings. The Contractor shall be responsible for proper fixing of the plumbing works strictly in accordance with engineering practice.

This work include complete items to make the system functional.

16.2.8 Water Filter

1) The water filtration system must comply with Pakistan Standards and Quality Control Authority (PSQCA) specifications and applicable ISO standards, specifically ISO 9001:2015 for quality management and ISO 14001:2015 for environmental management. The system should be a three-stage ultrafiltration (UF) type designed for kitchen use with removable and replaceable filters. The first stage must include a 5-micron sediment filter to remove large particles and sediments, the second stage must have a granular activated carbon (GAC) filter to remove chlorine, odors, and organic compounds, and the third stage should use a UF membrane with a pore size of 0.01 microns to remove bacteria and viruses, ensuring the water is potable. The filtration system must be made from food-grade, BPA-free materials compliant with FDA standards. It should be designed for easy installation and maintenance, with each filter stage easily accessible for replacement.

2) The system should feature a compact design suitable for under-sink installation, with inlet and outlet connections compatible with standard plumbing fittings. It must be capable of handling a minimum flow rate of 1.5 liters per minute and operate effectively at water pressures between 1.5 and 4.0 bar. The system should include a user-friendly indicator for filter replacement and come with clear instructions for installation, use, and maintenance. Reputable manufacturers with proven track records should supply the filtration systems. Suppliers must provide compliance certificates, technical datasheets, and warranty documents, ensuring the system meets all required safety and performance criteria. The system must come with a minimum 2-year warranty against manufacturing defects.

16.2.9 Septic Tank

The work shall consist of furnishing all plant, labour equipment, appliances and materials and in performing all operations in connection with construction of Septic Tank including excavation, brick/block work, plastering, concreting, inlet and outlet pipes, manhole covers etc. in accordance with these specifications in the relevant sections and in reasonably close conformity with the lines, grades and dimensions shown in the drawings or directed by the Engineer.

16.2.10 Water Meter

1) Water meters shall be supplied by approved manufacturers such as

KSB, or other equivalent and approved manufacturers, and must comply with relevant international and local standards (e.g., ISO 4064, AWWA C700, etc.).

2) The water meter body shall be made of high-quality materials such as brass, bronze, or stainless steel, suitable for potable water applications. The components including impellers, seals and glass should be durable, made of corrosion free material and of high quality and grade.

3) Water meters shall be available in different sizes as per the size of pipe adopted for the rainwater harvesting system, including but not limited to 1/2-inch, 3/4-inch, 1 inch, or as per the project requirements.

4) Water meters must have an accuracy class of at least Class 1 or Class 2. The starting flow rate, minimum flow rate, and maximum flow rate should conform to the standards specified for the size of the meter. Functional tests, pressure tests, and accuracy tests must be conducted to ensure proper operation. A minimum warranty period of one year from the date of commissioning should be provided.

16.3 MEASUREMENT AND PAYMENT

16.3.1 Miscellaneous Items

Measurement and payment for miscellaneous items will be made in accordance with the provisions of this clause specified hereinafter.

16.3.1.1 Method of Measurement

Rolled Section Steel will be measured by the length in linear ft. for the work satisfactorily completed as shown in the Drawings or as directed by the Engineer.

Steel ladder/stairs will be measured by the length in linear ft. for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Brick Pavement will be measured by the area in square foot for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Level indicators shall be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Lightening Arrester shall be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Disinfection of overhead water tanks will be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Malleable cast iron rungs shall be measured by the number for the work satisfactorily provided & laid as shown on the drawing or as directed by the Engineer.

Manhole covers shall be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Air vents shall be measured by the number for the work satisfactorily completed as shown on the Drawings or as directed by the Engineer.

Concrete service ducts shall be measured by the number of linear foot of duct satisfactorily provided & laid as shown on the drawing or as directed by the Engineer.

Mild steel bar screen and galvanized mild steel grating shall be measured by the area in the square ft. for the work satisfactorily provided & installed as shown on the drawings or as directed by the Engineer.

No measurement for fixtures along with plumbing works will be made. Lump sum will be the basis for payment.

Measurement will be made for each item of fan and accessories all acceptably supplied and installed by the contractor as a complete unit.

Septic Tank along with items as shown in the drawing shall be measured by the number for the work satisfactorily completed as directed by the Engineer.

Penstock gate alongwith complete assembly and fixation as shown in the drawing shall be measured by the number for the work satisfactorily completed as shown on the drawing or as directed by the Engineer.

16.3.1.2 Basis of Payment

Payment will be made in accordance with the unit prices in the Bill of Quantities of the various items in accordance with the specifications and shall constitute full compensation for furnishing all materials, equipment and labour and for performing all operations necessary to complete the work.

Pay Item	Description	Unit
16.1	Provide, fix and paint rolled steel section.	Lft.
16.2	Provide and lay brick pavement as shown on drawings or as directed by the Engineer.	Sft.
16.3	Provide and fix level indicator complete in all respects as per drawings and specifications or as directed by the Engineer.	No.
16.4	Provide and fix lightening arrester, copper earth strips and all other accessories complete in all respects as per drawings or as approved by the Engineer.	No.
16.5	Clean, test and disinfect overhead water tank.	No.
16.6	Provide and lay underground concrete service ducts of types as shown on the drawings or as directed by the Engineer.	Lft.
16.7	Provide and fix all toilet fixtures along with plumbing works complete with all accessories fittings, manhole chambers, gully traps, as shown in drawings or as directed by the Engineer	Lump sum
16.8	Construction of septic tank complete in all respects as per drawings and specifications.	No.

SECTION 15411
PLUMBING VALVES

PART 1 GENERAL

1.01 SCOPE OF SECTION

A. This technical specification establishes the type and quality of materials, and the standard of workmanship to be used in the supply and installation of valves.

1.02 WORK INCLUDED

A. The work includes the provision of all labour; materials and the performance of all operations in connection with the supply and installation of valves as specified herein and where referred to on the Drawings.

B. Co-ordination: The contractor shall be responsible for the full co-ordination of the work of all trades.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of valves whose products have been in satisfactory use in similar applications for not less than 10 years.

B. Installer: Firms regularly engaged and qualified in the installation of valves with at least 5 years successful installation experience on projects of a similar nature.

1.04 APPLICABLE CODES AND STANDARDS

A. The valves and all associated materials shall comply fully with the latest relevant British Standards in all respects.

The following are the most commonly used and relevant British Standards associated with valves and associated materials. However, the Contractor shall ensure that all applicable British Standards are complied with, whether listed here or not.

BS: 21	-	Specification for Pipe Threads for Tubes and Fittings where Pressure Tight Joints are made on the Threads.
BS: 4504	-	Circular Flanges for Pipes, Valves and Fittings (PN designated).
BS: 5150	-	Specification for cast iron gate valves.
BS: 5151	-	Cast Iron Gate (Parallel Slide) Valves.
BS: 5152	-	Cast Iron Globe and Globe Stop and Check Valves for general purposes.
BS: 2879	-	Draining taps (screw down pattern).
BS: 5153	-	Cast Iron Check Valves for general purposes.
BS: 5154	-	Copper Alloy Globe, Globe Stop and Check, Check and Gate Valves.
BS: 5155	-	Butterfly valves.

BS: 5156 - Diaphragm Valves.

BS: 6683 - Guide to Installation and Use of Valves.

1.05 SUBMITTALS

A. Drawings - refer to Section 15010

B. Products - submit full manufacturer data for every item.

1.06 OPERATION AND MAINTENANCE DATA

A. Comply with Section 15010.

1.07 WARRANTY

A. Provide 12 month warranty in accordance with contract conditions.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves, cocks, air vents and pipework specialties shall be provided where indicated on the Drawings and at all positions necessary for the proper working, regulation, control and maintenance of the installation with the approval for the Engineer.

B. All valves and cocks shall be suitable for the temperatures, working and test pressures applicable to each system.

C. All valves cocks vents and specialties must be fitted in such a manner that they are accessible for operation and maintenance.

D. All valves, cocks, vents and specialties installed for the work specified in this Contract shall be of the manufacturer specified hereafter or equal and approved by the Engineer.

2.02 VALVES

A. BRASS BALL / GATE VALVE

Valves to be class 125, made of brass with special seal for PPR hot water connection, inlet: soldered socket, outlet: union with drain.

Make: KITZ or approved equal.

B. BACK FLOW PREVENTOR

Back flow Preventor brass check valve class 125 suitable for vertical or horizontal installation. Seat, Cone and cone pressure spring of bronze including all accessories required for connection with piping.

Make: KITZ or approved equal.

C. AIR RELEASE VALVE

Air release valve to be of threaded ends, automatic type with manual drain plugs, cast iron body, aluminum cover, EPDM seat, suitable to be mounted on wall.

D. SAFETY VALVES

Brass body safety relief valve for pressure and temperature, with stainless steel spring (adjustable) suitable for installation on hot water storage tanks and heaters.

PART 3 EXECUTIONS

3.01 STORAGE

A. All valves shall be stored within a well lit container on purpose made compartmented racks or shelves, constructed in a similar manner to support the entire weight of materials without noticeable deformation.

B. The valves shall be separated by means of their type and size and laid out in an orderly manner for ease of identification.

C. Valves shall be supplied and stored with purpose made or manufactured plugs to prevent ingress of dirt.

3.02 GENERAL INSTALLATION

A. Valves with screwed ends shall have a union installed adjacent to the valve for ease of dismantling.

B. Where possible, valves shall be installed with the stem in the vertically upright position. However, all valves shall be installed in a manner such that they are readily accessible for ease of operation.

C. Sufficient clearance shall be allowed for the application of thermal insulation, valve boxes, etc. and to ensure that full travel of the valve stem can be achieved.

3.03 ISOLATING VALVES

A. Separate isolating valves shall be provided on all pipework services to each item of plant or equipment and on each main and sub main, except where flow measuring or regulating valves are required and these valves can be used for isolating purposes without affecting their measuring or regulating functions.

3.04 AIR VENTING DEVICES

A. Air venting devices shall be installed at all system high points.

B. Automatic air eliminators shall be complete with copper relief pipework, taken to within 1.5 m of the floor level with gunmetal isolating valve and extended to a position where any discharge will not damage building fabrics, decorations or the like.

C. Air bottles shall be made from 50mm size tube. Each shall be a minimum of 150mm long, fitted with a cap and 8mm size air cock. Where an air bottle is fixed out of reach, a 15mm extension tube shall be run from the cap to within 1.5m of the floor level and terminating with a needle valve and hose union.

END OF SECTION 15411

SECTION 15410

PLUMBING PIPING

1.0 GENERAL

1.01 SCOPE OF SECTION

A. This technical specification establishes the minimum requirements for the equipment to be incorporated into the above ground Soil, Waste, Rainwater and Hot and Cold water services plumbing pipework.

B. It also establishes the quality of materials and workmanship to be used in the supply and installation of the systems.

1.02 WORK INCLUDED

A. Provision of all labour, materials and the performance of all operations necessary for the supply and installation of pipework and fittings of the above ground Soil, Waste, Rainwater and Hot and Cold water services systems as specified herein and as detailed on the Drawings.

B. Co-ordination: The Contractor shall ensure that the soil and waste systems are fully compatible with all trades, particularly those of the Civil, Mechanical and Electrical services, for successful installation and operation.

C. Submittals: The Contractor shall submit to the Engineer for review and approval, all calculations and drawings for the equipment proposed and associated builder's works to show that the plant as installed will meet all the specified criteria.

No works shall commence on the site until the design has received the approval of the Engineer.

1.03 QUALITY ASSURANCE

A. Manufacturers: The contractor shall only propose the use of materials produced by firms who have been regularly engaged in the manufacture of plumbing pipework systems and whose products have proved satisfactory in similar service for not less than 10 years.

B. Installer: Firms proposed for the installation of the plumbing pipework systems shall have been regularly engaged for at least 5 years in the installation of plants of a similar type, quality and scope as is required for this project.

1.04 APPLICABLE CODES AND STANDARDS

A. The plumbing pipework shall comply fully with the latest relevant British/American and Standards in all respects.

B. The following are the most commonly used and relevant British/American and Standards associated with Soil and Waste Systems. However the Contractor shall ensure that all applicable British/American Standards are complied with, whether listed here or not.

BS 1387 - Galvanized steel medium and heavy duty.

BS: 1740 - Wrought steel pipe fittings.

BS 2494 - Elastomeric joint rings for pipe work and pipelines.

BS 2779 - Pipe threads. For tubes and fittings where pressure-tight joints are not made on the threads

BS: 3380 - Wastes (excluding skeleton sink wastes) and bath overflows.

BS: 3505 - Specification for uPVC pressure pipes.

BS 3605 - Austenitic stainless steel pipes and tubes for pressure purposes.

BS: 3943 - Plastic waste traps.

BS: 3974 - Pipe supports. (Part 1 & 2) BS 4346 - Joints and fittings for use with uPVC pressure pipes.

BS 4346 - Joints and fittings for use with uPVC pressure pipes.

BS 4368 - Compression coupling for tubes.

BS: 4514 - Unplasticized PVC soil and ventilating pipes, fittings and accessories.

BS: 4660 - Unplasticized PVC underground drainpipe and fittings.

BS: 4991 - Specification for Propylene Copolymer Pressure Pipe.

BS 5114 - Performance requirements for joints and compression fittings for use with polyethylene pipes.

BS: 5254 - Polypropylene waste pipe and fittings.

BS: 5255 - Plastic waste pipe and fittings.

BS: 5481 - Unplasticized PVC pipes and fittings for gravity sewers.

BS: 5572 - Sanitary pipework.

BS: 6087 - Flexible joints for grey or ductile cast iron drainpipes and fittings and for discharge and ventilating pipes and fittings.

BS: 6367 - Drainage of roofs and paved areas.

BS 6700 - Design, installation, testing and maintenance of services supplying water for domestic use within buildings and their cartilages.

BS: 8000 - Part 13 - Above ground drainage and sanitary appliances.

BS: EN 545 - Ductile iron pipes, fittings, accessories and their joints for water pipelines. Requirements and test methods.

BS: EN 598 - Ductile iron pipes, fittings accessories and their joints for sewerage applications Requirements and test methods.

ASTM B88 - Specification for Seamless Copper Water Tube.

ASTM B306 - Specification for Copper Drainage Tube (DWV)

ANSI B16.22 - Wrought Copper and Copper Alloy Solder - Joint Pressure Fittings

ANSI B16.29 - Wrought Copper and Copper Alloy Solder - Joint Drainage Fittings

ANSI A135 - Specifications for Electric Resistance Welded Steel Pipe

ASTM A53 - Pipe, steel, Black and not dipped, zinc – coated welded and seamless.

UPC - Uniform Plumbing Code.

1.05 SUBMITTALS

A. Drawings - refer to Section 15010

B. Products - submit full manufacturer data for every item.

1.06 OPERATION AND MAINTENANCE DATA

A. Comply with Section 15010.

1.07 WARRANTY

A. Provide 12 month warranty in accordance with contract conditions

2.0 PART 2 PRODUCTS

2.01 PIPES AND FITTINGS SHALL BE IN ACCORDANCE WITH THE FOLLOWING SCHEDULE: -

Service	Material
Main soil, waste and vent Pipes and Rain water pipes	Un-plasticized polyvinyl chloride (uPVC) Type-B as per BS 3505
Branch waste and vent pipes	Un-plasticized polyvinyl chloride (uPVC) Type-B as per BS 3505
Water Line from Tube well to UGWT	uPVC Class B as per BS 3505
Water Line from KWB's External Line to UGWT	uPVC Class B as per BS 3505
Cold and Hot Water Supply	PPRC PN 20 As per DIN 8077-8078
Condensate drains	Unplasticized polyvinyl chloride (uPVC) Concealed location & G.I. at Roof level and Mechanical room.

2.02 MATERIALS

A.

1. Unplasticized Polyvinyl Chloride (uPVC) pipework and fittings for Soil, Waste and Vent.

2. Pipework shall be installed in uPVC pipes confirming to ISO 3633and EN1329 Sanitary drainage above / under ground or in the wall applications.

3. Jointing of pipework and fittings shall be by the use of solvent weld sockets carried out in accordance with the manufacturer instructions. Solvent weld cement shall be of a type approved by the manufacturer of the pipework being jointed. Or with rubber ring socket Joints (ISO 4633) and all accessories.

4. Additional ring seal joints shall be provided as necessary to account for expansion and contraction.

B. Polypropylene Pipe work and Fittings.

1. Polypropylene PPRC (Green) pipework for hot and cold water supply as per DIN 8077- 8088 for pipes and DIN 16962 for fittings (polyfusion welded joints) inside the Building including all specials.

C. Galvanized Steel pipework (GS)

1. Galvanized steel pipework shall be to ASTM A53 grade A schedule 40.

2. Jointing of pipes shall be by flanged connection. Screwed joints shall not be used.

3. As an alternative to flanged connections Victaulic grooved couplings with EPDM seals may be used.

3.0 EXECUTION

3.01 SOIL, WASTE AND RAINWATER PIPEWORK

A. WORKMANSHIP

1. Materials and workmanship shall be of best quality and executed in accordance with the Specification, drawings and manufacturers recommendations.

2. Where any pipe is required to be shortened it shall be cut off square and cleanly with an approved pipe-cutting machine.

3. Where special joints or jointing materials are shown for pipes of any materials, they shall be of an approved type and manufacture, and the joint shall be made in accordance with the manufacturer's instructions, or as directed.

4. Responsibility shall be assumed to identify and install all necessary expansion couplings and fire sleeves throughout the installations.

5. All plant, pipes and fittings etc shall be thoroughly cleaned of all foreign matter before installation. Each section of the installation shall be clean and free from any obstructions whatsoever before proceeding with the next section of the installation.

6. Flexible joints are to be provided wherever pipes cross expansion joints.

7. All soil, waste, vent and rainwater pipes shall be to the sizes and positions indicated on the drawings to take the discharge from the branch waste and vent pipes, sanitary fittings and equipment adjacent thereto.

8. On completion the whole of the work is to be handed over in a sound and clean condition. In the event of any pipe being fractured from any cause

whatsoever after having been (to all appearances) properly installed, responsibility shall be assumed in every instance and any such defective pipes shall be replaced for approval.

9. All pipework shall be erected to present a neat and orderly appearance, arranged parallel to or at right-angles to the structural members of the buildings, giving maximum headroom and shall not obstruct windows or doorways. Pipework shall be erected such that there is a minimum clearance of 75 mm to finished floor level and a minimum clearance of 25 mm to finished wall faces.

10. Slopes of long-run drainage pipes (gravity) shall be as per design drawings and minimum of:

    3” dia. 1.33%

    4” dia. 1.00%

    6” dia. 0.67%

    8” dia. 0.57%

B. The discharge pipework shall be so installed as to minimize the risk of blockage. Access covers and/or rod ding eyes are to be positioned such as to enable maintenance equipment to be inserted into the system(s) to permit cleaning or clearing of all sections of the system(s).

The pipe work system and fittings are to be installed so that broken or defective parts can be easily removed and replaced.

The discharge pipe work shall ensure that there is no leakage of contaminated water or foul air into any building.

C. The work shall be set out and responsibility assumed for the accuracy of the same and the position of all fittings shall be approved by the Client's representative. When first setting to any work, consideration must be given to the work of other trades.

D. Responsibility shall be assumed for leaving all unfinished works in a safe condition during the progress of the works.

All materials & equipment are to be installed and protected in such manner as to be adequately covered against damage and deterioration, and during the execution of the work the open ends of all pipe work shall be temporarily plugged off by means of blank ends and compression caps respectively.

E. Vent pipe roof termination

1. Discharge stacks complete with domical cages shall terminate not less than 300 mm above the roof, 900 mm above and not less than 3000 mm, measured horizontally from any window or air conditioner.

2. Where the stack passes through floors, ceilings and roofs, the openings are to be perfectly sealed-off by proprietary fittings. They shall terminate with neoprene aluminum weathering slate, weathering collar; and a balloon grating on 180° bend.

F. All branch waste pipes to a range of fittings shall have on access provided on the

pipe in an accessible position at the end of the run.

G. All pipework shall be supported in accordance with the manufacturer recommendations. Pipe hangers and brackets shall be in accordance with section 15412 of this specification.

H. Sleeves shall be provided where pipes pass through walls or floors. Pipe sleeves shall be compatible with the pipes they protect; non-combustible and 1 ½ times the diameter of the pipe. Void between pipe and pipe sleeve shall be packed with mineral wool and sealed with approved mastic sealant.

I. Where plastic pipes 50mm diameter and larger pass through fire compartment walls, floors or ceiling cavity barriers they shall be fitted with in tumescent collars having the same fire resistance rating as the fire barrier they pass through. In tumescent collars shall be as Nullifier B150 pipe collars or approved equal.

J. All pipefitting shall be of the same colour as the pipework used.

K. All vertical soil and waste pipes shall have access doors on each floor fitted above the spillover level of fittings served. Where pipes are installed in ducts or built into walls access doors shall be provided in the duct wall or wall for access to the access door. The type and finish of the access shall be to suit the location and to the approval of the Architect.

L. Connection to sanitary fittings

All outlets shall be trapped and provided with accessible and adequate means of removal and cleaning. The traps shall be designed to be self-cleaning all surfaces and joints are to be smooth.

1. All traps with outlets for pipes up to and including 50 mm shall have a minimum water seal of 75 mm.

2. Traps with outlets for pipes of over 50 mm shall have a minimum water seal of 50 mm.

The waste pipes to the various sanitary fittings shall be of the following minimum sizes:

Wash basins	50-mm diameter
Sinks	50 mm diameter
WC's	110 mm diameter
Floor gullies	75-mm diameter

M. Condensate drains shall be provided from all fan coil units, packaged units etc. piped to the nearest floor drain, other suitable drain point or as indicated on drawings.

N. Drain pipes from fire protection system water test points shall be piped to the nearest suitable drain lines or as indicated on drawings.

O. Self siphon age tests

The contractor shall undertake tests for self-siphon age and induced siphon age in branch discharge pipes by filling each appliance to over flowing and then discharging by removing the plugs and discharging the W.C(s) at the upstream end of the discharge pipe. All seals are to remain in the traps. The numbers of sanitary appliances to be discharged for this performance test are enumerated below:

Type of Use	Number of appliances of each kind on the stack	Number of appliances to be discharged simultaneously		
		WC	Wash basin	Kitchen sink
Domestic	1 to 9	1	1	1
	24 to 24	1	1	2
Congested	1 to 24	1	1	
	5 to 9	1	2	
	10 to 13	2	2	
	14 to 26	2	3	
	27 to 39	3	4	
	40 to 50	3	5	

P. Testing and commissioning

1. All tests requested by Local Municipality on the entire installation shall be carried out, and all necessary appliance and equipment for this purpose shall be supplied.

2. Provision shall be made to carry out any test requested at any time during the progress of the works or after their completion.

3. Whilst phased testing may be carried out (which may or may not have been witnessed) the contractor shall be required to demonstrate the water tightness, alignment, and level and cleanliness of the whole installation seven days prior to the installation being handed over.

4. This requirement shall be discharged by the applying a full running water test to the whole installation as described below and by the drawing through of a drain profile, which will be provided, to the required detail.

5. All tests shall be carried out in the presence of the Client's representative, and a minimum of 48 hours notice shall be given of readiness to test any section of the installation. Test Certificates shall be submitted to the person witnessing the test for their signature of approval, to the effect that the system satisfies the requirements of this Specification.

6. All sections of works must be pretested to satisfy that the system will pass the required test, prior to carrying out the main test.

7. The Test Certificate shall be required to be completed for all sections of the installation.

8. After erection and immediately prior to sealing in, all rainwater, main soil, waste, vent and branch soil, waste pipes, shall be checked throughout for obstructions and finally tested for soundness.

9. The above ground sanitation and rainwater pipe installation shall be subjected to two air tests, one of 75 mm water gauge for a minimum period of 15 minutes prior to connection of sanitary fittings and building in of pipework, and a second air test on completion of the system with all traps and WC's connected when the test pressure shall be 45 mm water gauge for a minimum period of 15 minutes.

10. At start of testing, sanitation and Rainwater Pipework shall be checked for alignment and stability; mechanical joints shall be re-torquing where necessary.

11. Access doors shall be removed, felt washers greased and doors replaced.

12. The whole system shall be ridded through with an appropriately sized disc type plus the allowance shall also be made for testing to the Local Authority requirements and for carrying out separate and independent tests if required.

13. The provision shall also be made for obtaining an acceptance test certificate form the Local Authority on completion of the works. The test for the Local Authority shall be allowed for as an addition to the tests required under this specification.

3.02 HOT AND COLD WATER SERVICES PIPEWORK

A. Product handling

1. All products shall be delivered in manufacturer's original protective packaging. All products shall be inspected at time of delivery for damage and for compliance with Specifications. Any products that are found to be damaged or not in accordance with the Specifications shall immediately be repaired or removed from the site and replaced. Repairs shall not be undertaken before the Engineer's review of Contractor's proposed action.

2. All products shall be handled and stored as recommended by the manufacturer to prevent damage and deterioration. The Contractor shall supply handling equipment such as lifting beams, reinforced canvas slings, protective padding, struts, cradles, etc., required to handle the products without damaging hardware or linings and coatings.

3. Products shall be protected against damage and the ambient conditions both during transport, site storage and immediately up to the time products are installed. Precautions shall be taken to protect the product from mechanical damage and the effects of sunlight and heat, until the backfilling operations have been completed. All site storage areas shall be shaded.

B. Installation of pipework

1. Pipework from the water meter to the inside of the buildings where running

below ground level shall be Polyethylene (P.E) and the distribution within Buildings shall be Polypropylene (PPRC pipes, appropriate for the working pressure. The installation of Polypropylene pipe works (PPRC pipes) should strictly comply with respective approved manufacturer recommendations or DIN 1988, part2.

Joints in buried pipework shall be kept to the absolute minimum. Marker tapes with embedded metal strip shall be laid 150 mm above the pipework. If valves are required, they are to be in a valve chamber with the surface box lettered to indicate what service is below them.

2. The underground pipework shall be laid in 200 mm of sand or stone free bedding material and wherever possible in straight lines to uniform gradients. The clearance between the pipework and footings of the buildings is not to be less than 200 mm. If less, the pipes shall be installed in a flexible sleeve.

3. All pipework shall run vertically or at an inclination of 1^{o} to the horizontal to enable the whole system to be drained off either through the system or through a valve discharging externally with an air gap to prevent contamination by backflow. When the pipework is drained down, air is to be allowed into the system to prevent failure or damage to the hot water cylinder. A manual air inlet value shall be fitted to the high point in the system to achieve this.

4. Where pipes are run chased into walls, floors, etc., all pipework shall be insulated.

5. All pipework shall be erected to present a neat and orderly appearance, arranged parallel to or at right-angles to the structural members of the buildings, giving maximum headroom and shall not obstruct windows or doorways. Pipes shall bend round piers, projections and into recesses forming part of the structural works whether so indicated on the drawings or not. Pipework shall be erected such that there is a minimum clearance of 75 mm to the finished floor level and at least 25 mm to the finished wall faces.

6. All fittings shall, as far as practicable, be the same size as the tubes and pipes connected to them. Bushed outlets will only be accepted if the required outlet size of a fitting is not of standard manufacturer. Eccentric bushings and square tees shall be used where concentric bushing and pitcher tees might cause air to be trapped in the system. Elsewhere, square tees shall be confined to dead-leg branches of domestic hot water supply systems and on cold-water branches to fitting or ranges of fittings.

7. Elbows shall be used, where practicable, in preference to bends. Square elbows will not be permitted.

8. Pipework shall follow the contours of walls and shall be graded to ensure venting and draining. The clearance between pipework (or the insulation) and the wall and any other fixtures shall be not less than 20 mm.

9. Purpose-made sets or springs may be used where it is necessary to deviate from a straight run.

10. Sets or springs in tubes of 50-mm size and above shall be fire-made and tubes shall remain circular after setting.

11. Eccentric reducing sockets shall be used where changes of bore are made in runs of nominally horizontal pipework to facilitate air venting and draining.

12. Tubes shall be reamed after cutting and shall be free from burrs, rust scale and other defects and shall be thoroughly cleaned before erection. Open ends left during the progress of work shall be temporally closed with purpose-made metal or plastic plugs or caps, or blank metal flanges.

13 Where pipework passes through walls, floors or ceilings, sleeves shall be provided. Pipework passing through flooring shall be provided with approved type floor and ceiling plates fastened securely to the pipe. The sleeves to be of the same metal as the pipe.

13. All entry and exit holes to or from a building for pipework services shall be sealed and plugged. For service conditions below 60ºC the sealant shall be mastic compound, above this temperature it shall be silicon rubber. Where the pipework enters the building through a large hole or duct, a mild steel blanking plate not less than 6 mm thick shall be built into the walls of the hole or duct. The service pipes shall pass through clearance sockets welded to the plate and the space between pipe exterior and socket interior shall be sealed and plugged.

14. Pipework of 75 mm size and larger subject to expansion and contraction and hung from supports shall be suspended on swivel hangers unless otherwise agreed.

15. Hangers for horizontal pipework shall be supported in accordance with the requirements of Section 15412-Support, Hangers and Brackets.

16. Piping that is insulated shall be secured by clips that allow sufficient space behind the back of the pipe for the pipe insulation to be properly installed.

17. All pipework shall be installed so that the vertical distance between the discharge point and overflow level of the receiving appliance shall not be less than 25 mm for taps and/or fittings up to and including 20 mm and 70 mm for those over 20 mm to prevent contamination as result of backflow of water.

18. A 15-mm diameter washout pipe, discharging outside the building shall be provided at ground floor level to drain the system. The top of the outlet is to be in excess of 70 mm from the ground or receiver.

19. Double check valve assemblies or other suitable backflow preventer shall be installed on cold water makeup to HVAC equipment and wherever equipment is supplied that may allow backflow.

20. Water hammer arrestors shall be provided on horizontal piping to fixtures and equipment having quick closing valves or flush valves and as indicated

on the drawings.

21. Where drinking water and non-potable water supply points are installed, they shall be clearly marked to provide ready identification. Every drinking water point shall be segregated from fire fighting water supply points. Every drinking water pipe shall be readily distinguishable from other pipes. Drinking water hoses and flexible pipes shall be marked to prevent them being used for cleaning purposes.

22. Double check valve assemblies or other suitable backflow preventer shall be installed on cold water makeup to HVAC equipment and wherever equipment is served that may allow backflow.

23. Water hammer arrestors shall be provided on horizontal piping to fixtures and equipment having quick closing valves or flush valves and as indicated on the drawings.

C. Storage

1. All pipework shall be stored on purpose made pipe racks of welded construction and of sufficient strength to support the entire weight of the materials without any noticeable deformation. The racks shall be such that all pipework is clear of the ground.

2. All black steel pipework shall be given one coat of red oxide paint immediately after delivery and prior to storage. The open ends of the pipework shall be blanked off with purpose made or manufactured plugs.

3. Pipework fittings shall be stored within a well-lit container made compartmented racks or shelves. The fittings shall be separated by means of their type and size and laid out in an orderly manner for ease of identification.

D. System testing

1. The Contractor shall ensure that all pipework is watertight to the satisfaction of the Engineer and shall supply all pressure gauges, meters, hoses, pumps and other temporary supports, equipment and manpower necessary for carrying out pressure tests.

2. The Contractor shall, during testing, check the satisfactory operation of each valve installed under the Contract.

3. Before filling or pressure testing is started the Contractor shall re-check pipes and valves for cleanliness and shall re-check the operation of valves. The open ends of the pipes shall normally be stopped off by blank flanges or capped ends additionally secured where necessary by temporary struts and wedges.

4. Potable water system shall be tested with water to 1.5 times the normal system working pressure or 6 bar whichever is greater while uncovered but adequately anchored. The testing shall be carried out in sections if necessary. If a section should fail the test, the Contractor shall trace and

repair all leaks and defects and retest the section before any further pipes or section of adjacent pipework are laid.

5. The system shall be filled with potable water and all air expelled. After the system has been completely filled, the pressure shall be steadily and gradually increased until the test pressure has been reached. If any loss is recorded, repairs shall be made and the test re-run.

6. Written records of every test clearly identifying the tested system together with time of test and name of testing Engineer in tabulated format shall be submitted for review by the Engineer upon completion of the test.

E. Flushing and disinfection

1. All visible dirt and debris shall be removed from the tank and pipes.

2. The tank and distributing pipes shall be filled with clean, potable water and then drained until empty of all water.

3. The tank shall be filled with clean potable water and supply closed.

4. A measured quantity of sodium hypochlorite solution of a known strength shall be added to the water in the tank to give a free residual chlorine concentration of 50mg/L (50ppm) in the water.

5. The tank shall be left to stand for 1 hour.

6. Each draw off fitting shall be successively opened working progressively away from the tank.

7. Each tap and draw off fitting shall be closed when the water discharged smells of chlorine.

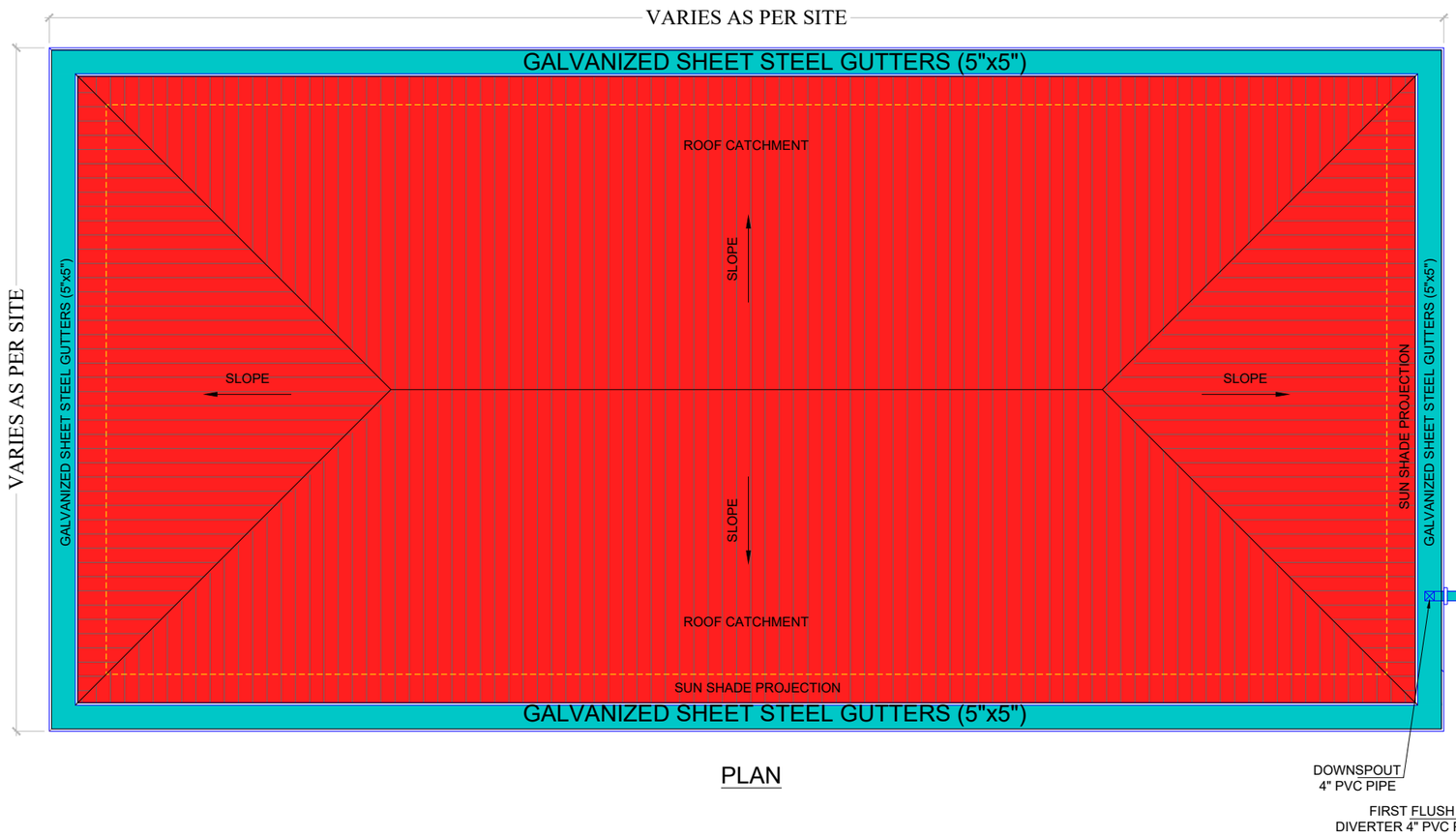
8. The tank shall not be allowed to become empty during this operation. If necessary it shall be refilled and chlorinated as above.

9. The cistern and pipes shall then remain charged for a further 1-hour.

10. The tap furthest from the cistern shall be opened and the level of free residual chlorine in the water discharged from the tap measured. If the concentration of free residual chlorine is less then 30mg/L (30 ppm) the disinfecting process shall be repeated.

11. Finally, the tank and pipes shall remain charged for at least 16 hours and then thoroughly flushed out with clean, potable water until the free residual chlorine concentration at the taps is no greater then 21 mg/L (21ppm).

END OF SECTION 15410



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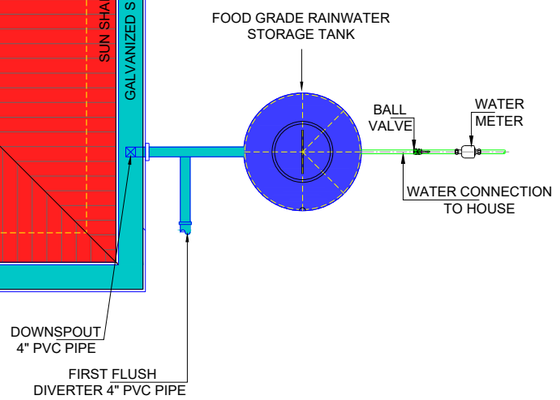

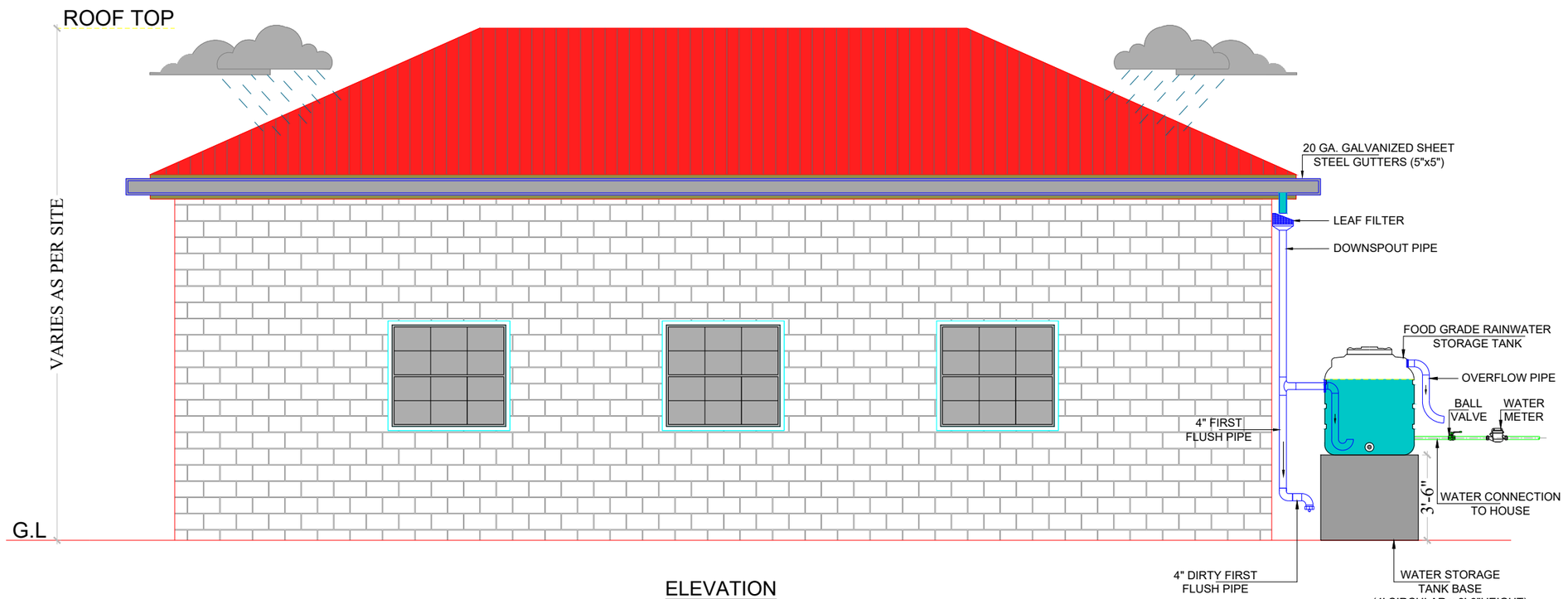

ELEVATION

CLIENT:
URBAN SECTOR PLANNING AND MANAGEMENT SERVICES UNIT (PVT.) LTD.

The Urban Unit

SPONSORING AGENCY:

Local Government & Community Development Department

CONSULTANTS:
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Tel : (92-42) 35441641, 35441642
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URL : www.g3ec.com

PROJECT:

MURREE ROOFTOP RAINWATER HARVESTING PROJECT

ROOFTOP RAINWATER HARVESTING IN MC MURREE

NOTES:

1. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2.

REVISIONS:

No.	DESCRIPTION	DATE

(TENDER DRAWING)

3-MARLA HOUSE

DRAWING TITLE:

LAYOUT PLAN AND ELEVATION

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/01-PH	REV:
SCALE (A3):	SHEET:

FOOD GRADE RAINWATER STORAGE TANK DETAIL

NO.	MARLAS	CAPACITY (GALLONS)	DIA	HEIGHT
1	3	300	44"	49.5"

SIZING OF FIRST-FLUSH DIVERTER

AREA OF PLOT	TOTAL AREA	EFFECTIVE AREA	REQUIRED VOLUME	DIA	LENGTH	VOLUME AVAILABLE
Marla	sft	sft	gallons	Inch	feet	gallons
3	817	572	4.8	4	9	4.9

NOTE:

- Tanks dimension may vary as per individual brands and subject to approval of client and/or Engineer Incharge.
- Tank Pedestal Height may vary as per site.
- Roof dimensions may vary as per site requirements and subject to detailed design by the contracting firm.
- Detailed designs of Rainwater Harvesting Systems for individual households subject to approval of client and/or Engineer Incharge.
- Gutter sizing has been based upon the design manual of Development Technology Unit, University of Warwick
- Contractor shall prepare the shop drawings as per actual site conditions and will submit the drawing for consultant's approval prior to execution.

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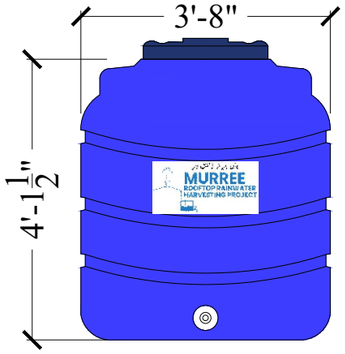
No.	DESCRIPTION	DATE

(TENDER DRAWING)

3-MARLA HOUSE

DRAWING TITLE:
GENERAL NOTES

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/02-PH	REV:
SCALE (A3):	SHEET:



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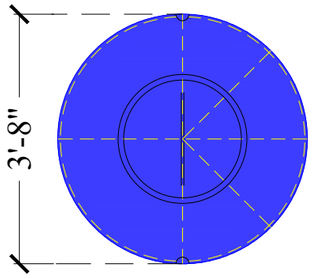
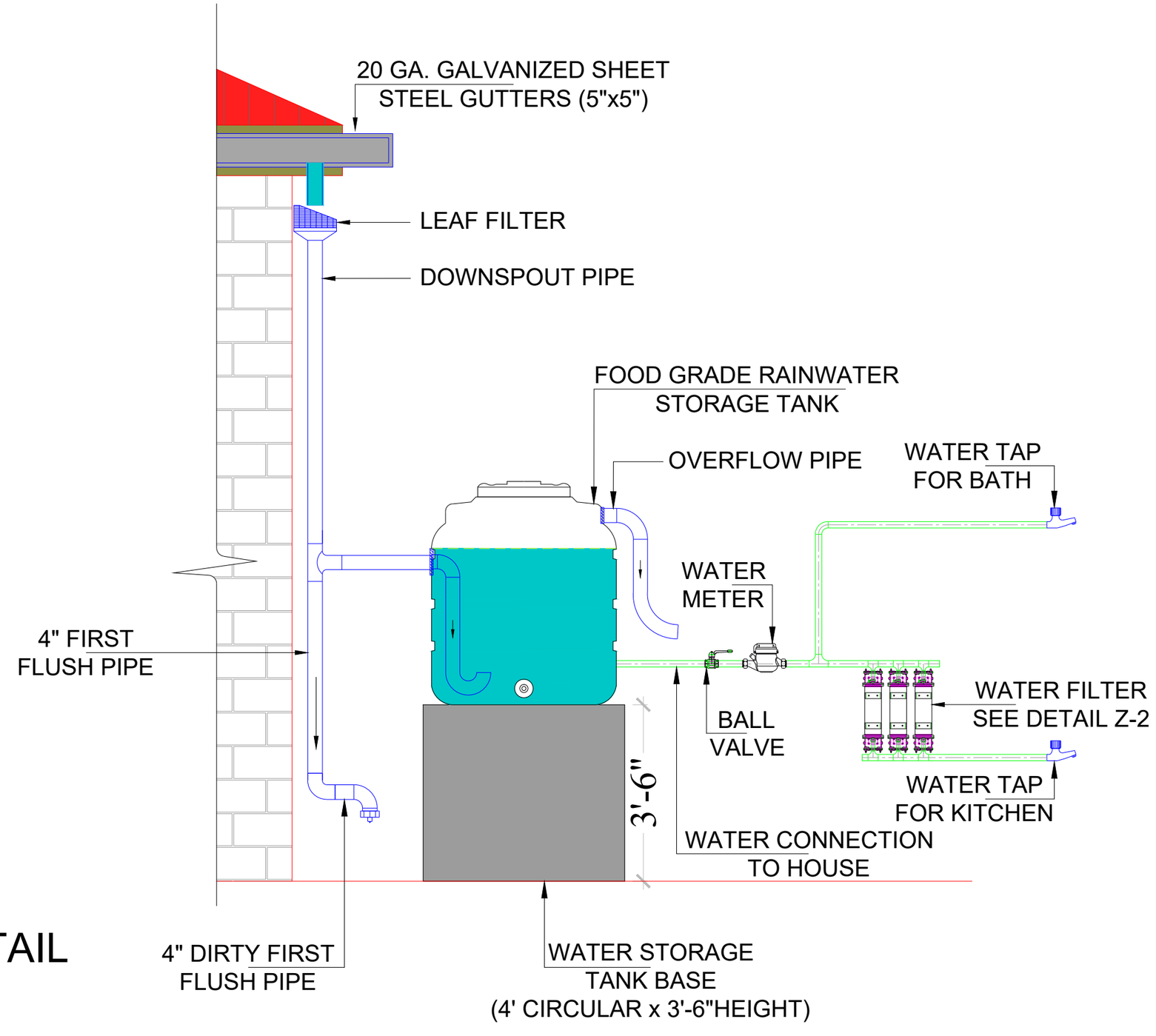


PLAN

STORAGE TANK DETAIL



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2.

REVISIONS:

No.	DESCRIPTION	DATE

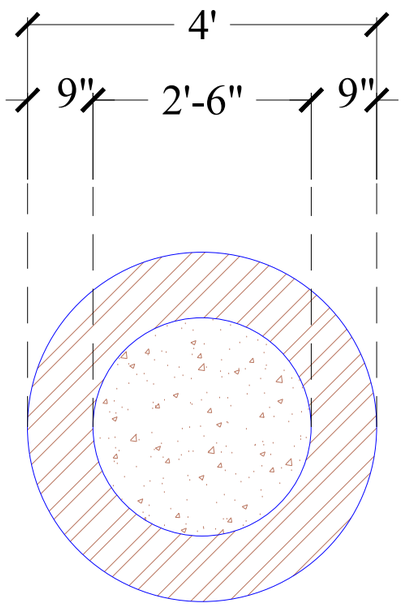
(TENDER DRAWING)

3-MARLA HOUSE

DRAWING TITLE:

STORAGE TANK PLAN FILLING AND HOUSE CONNECTION DETAIL

DRAWN BY:	DATE:
Mr. Z	AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/03-PH	REV:
SCALE (A3):	SHEET:



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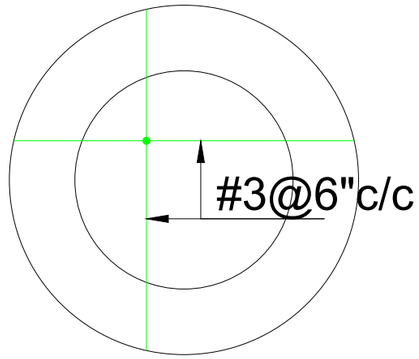

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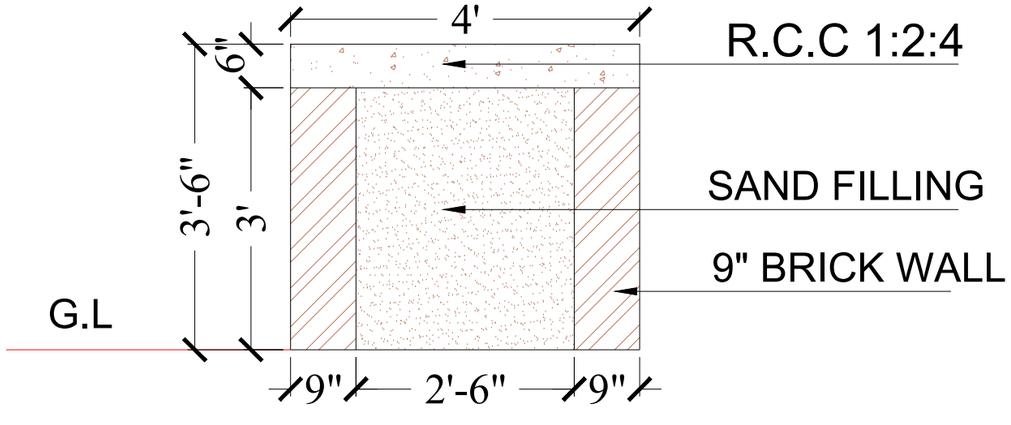
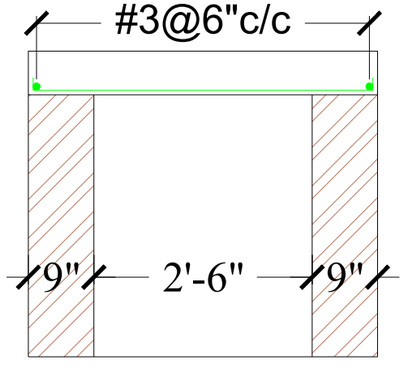


SECTION
FOUNDATION DETAIL



SECTION
REINFORCEMENT DETAIL

CLIENT:
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REVISIONS:

No.	DESCRIPTION	DATE

(TENDER DRAWING)

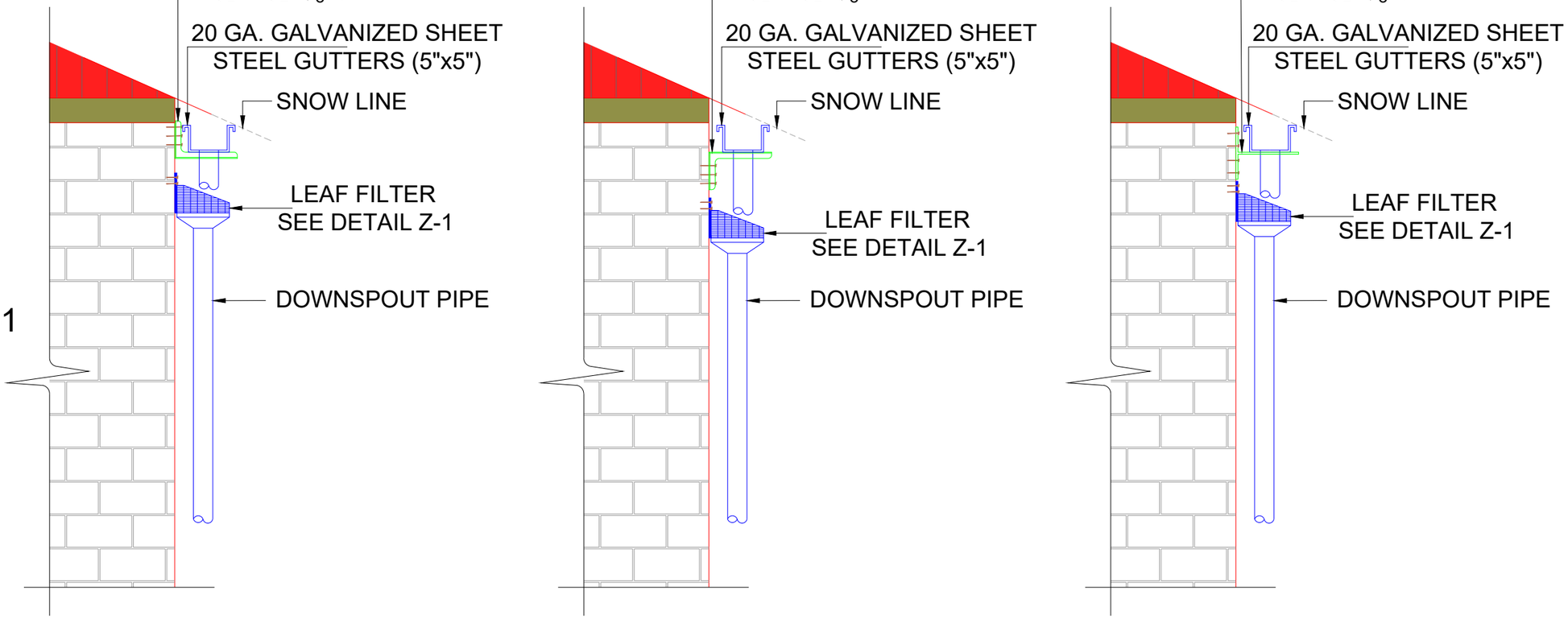
3-MARLA HOUSE

DRAWING TITLE:

TANK BASE FOUNDATION AND REINFORCEMENT DETAILS

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/04-PH	REV:
SCALE (A3):	SHEET:

OPTION-1



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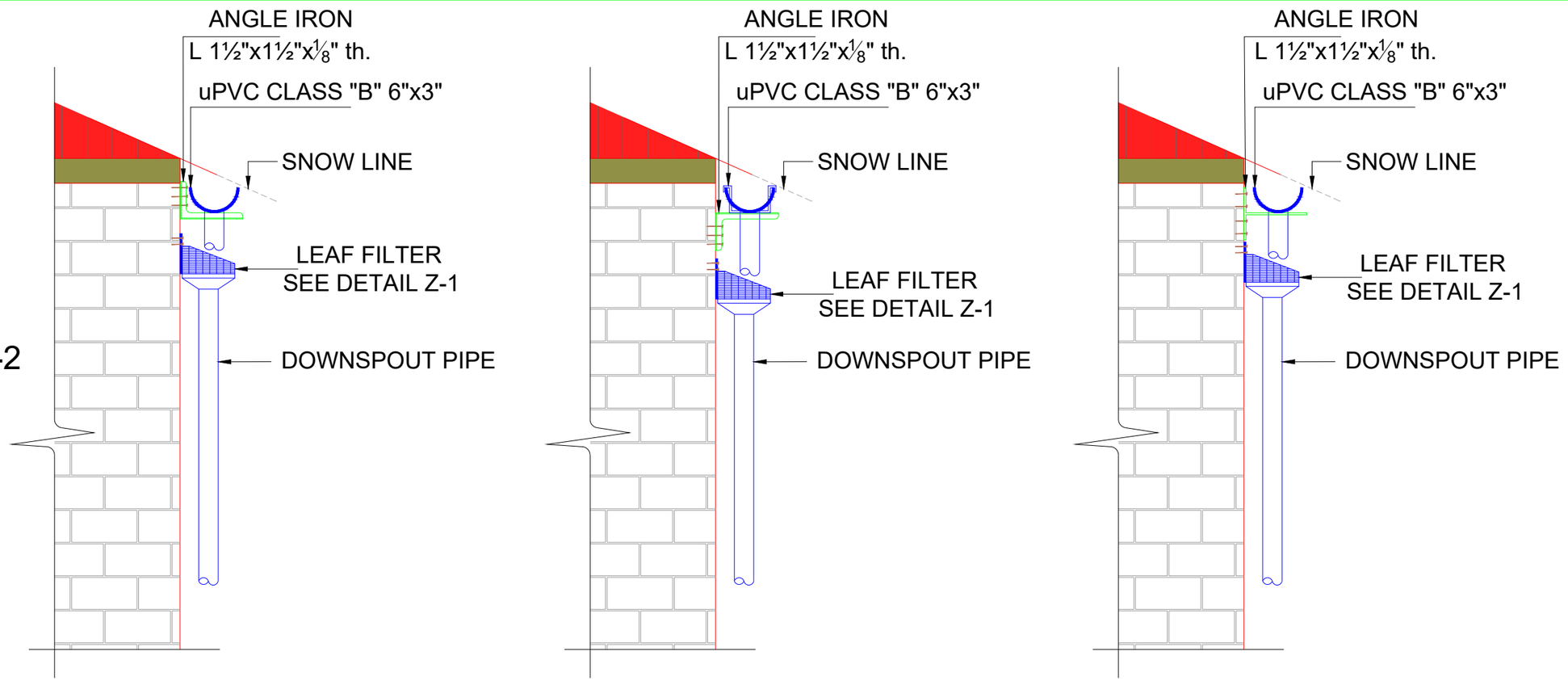

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URL : www.g3ec.com

PROJECT:
MURREE ROOFTOP RAINWATER HARVESTING PROJECT
ROOFTOP RAINWATER HARVESTING IN MC MURREE

NOTES:
1. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2.

REVISIONS:

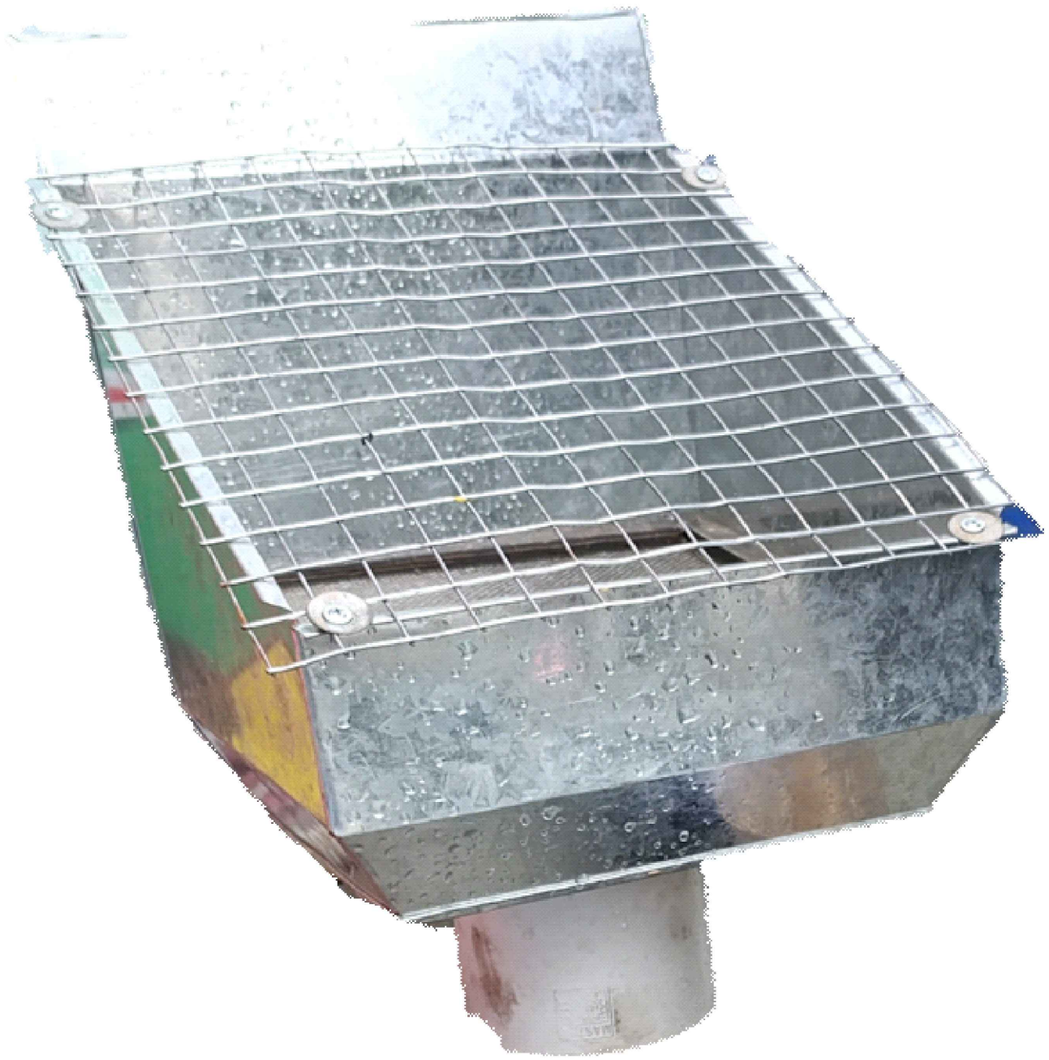
No.	DESCRIPTION	DATE

(TENDER DRAWING)

3-MARLA HOUSE

DRAWING TITLE:
STEEL GUTTER AND uPVC PIPE DETAILS

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/05-PH	REV:
SCALE (A3):	SHEET:



LEAF FILTER DETAIL Z-1

WATER FILTER DETAIL Z-2

CLIENT:
URBAN SECTOR PLANNING AND MANAGEMENT SERVICES UNIT (PVT.) LTD.

The Urban Unit

SPONSORING AGENCY:

Local Government & Community Development Department

CONSULTANTS:
G3 ENGINEERING CONSULTANTS (PVT)LTD.
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Tel : (92-42) 35441641, 35441642
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PROJECT:

MURREE ROOFTOP RAINWATER HARVESTING PROJECT

ROOFTOP RAINWATER HARVESTING IN MC MURREE

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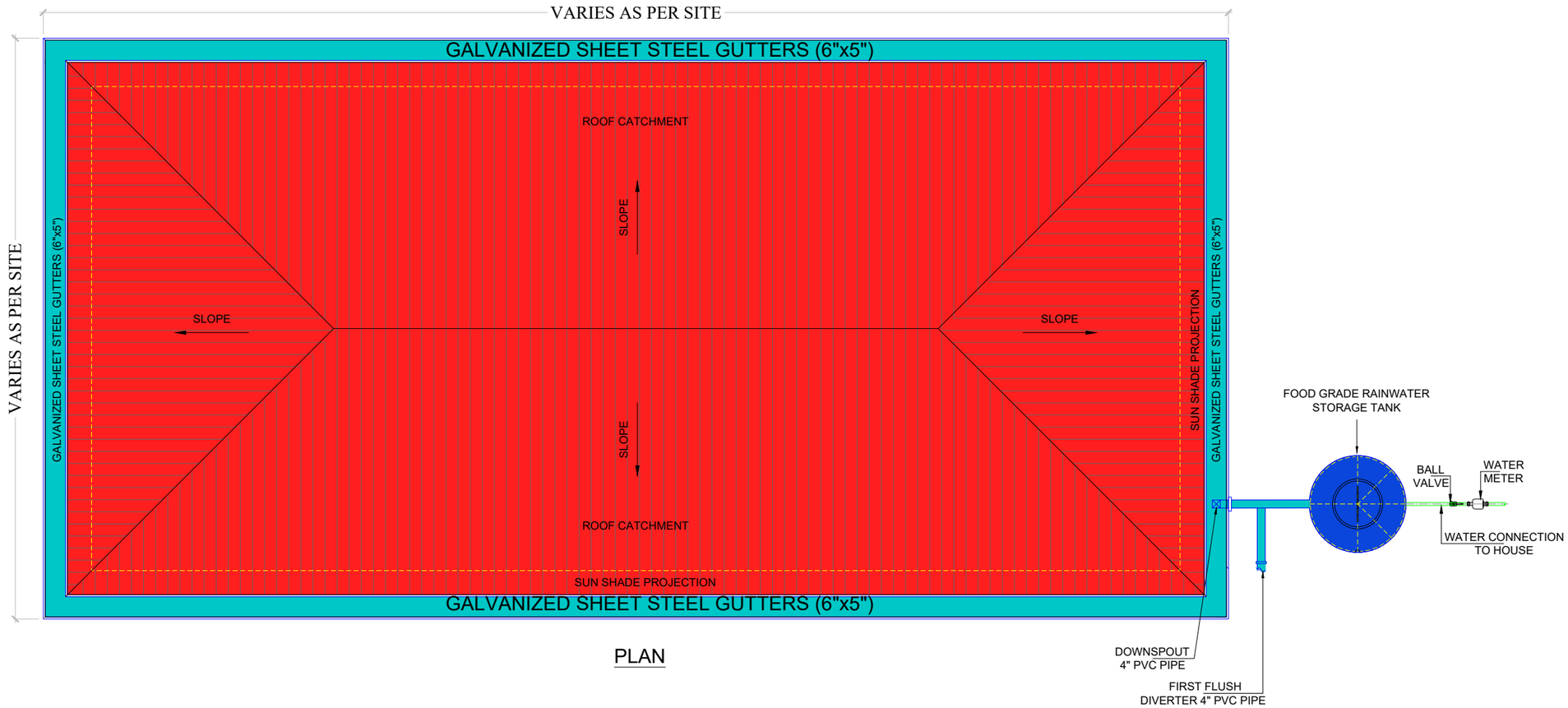
3-MARLA HOUSE

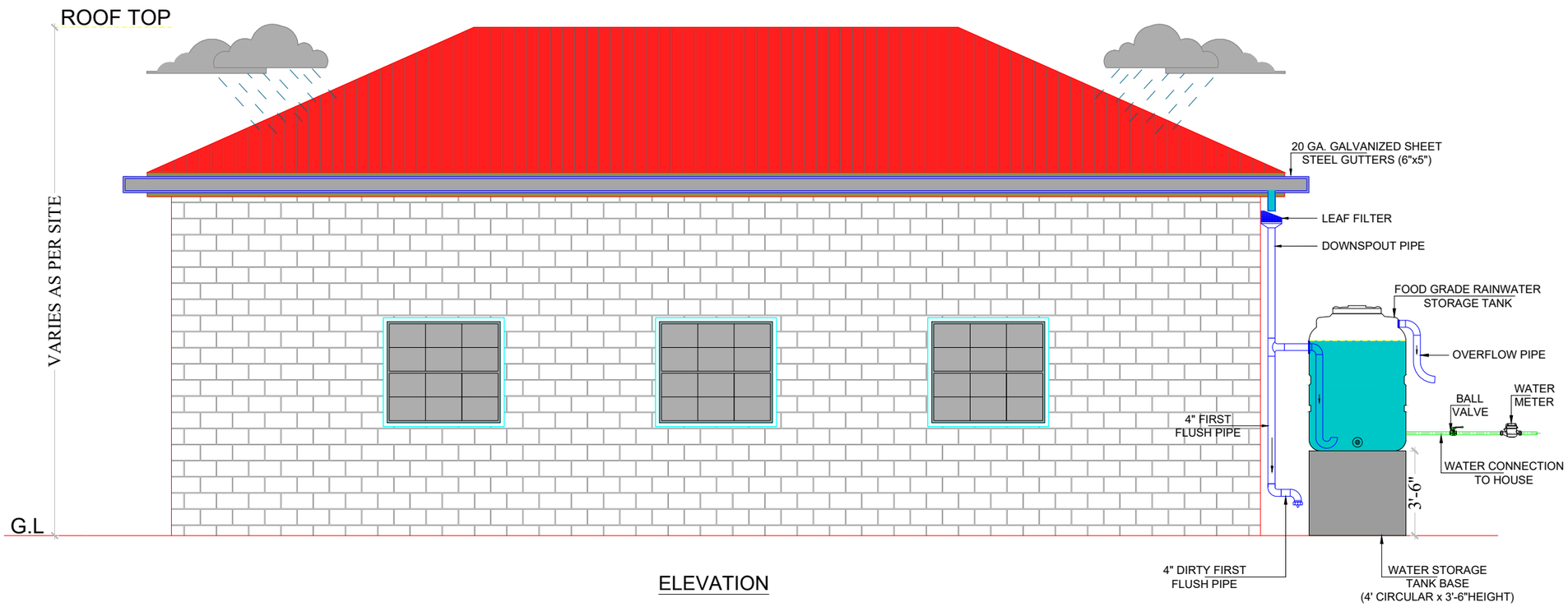
DRAWING TITLE:

MISCELLANEOUS DETAILS

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/06-PH	REV:
SCALE (A3):	SHEET:



PLAN



ELEVATION

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REVISIONS:

No.	DESCRIPTION	DATE

(TENDER DRAWING)

4-MARLA HOUSE

DRAWING TITLE:

LAYOUT PLAN AND ELEVATION

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/01-PH	REV:
SCALE (A3):	SHEET:

FOOD GRADE RAINWATER STORAGE TANK DETAIL

NO.	MARLAS	CAPACITY (GALLONS)	DIA	HEIGHT
1	4	500	48"	68"

SIZING OF FIRST-FLUSH DIVERTER

AREA OF PLOT	TOTAL AREA	EFFECTIVE AREA	REQUIRED VOLUME	DIA	LENGTH	VOLUME AVAILABLE
Marla	sft	sft	gallons	Inch	feet	gallons
4	1089	762	6.4	4	12	6.5

NOTE:

- Tanks dimension may vary as per individual brands and subject to approval of client and/or Engineer Incharge.
- Tank Pedestal Height may vary as per site.
- Roof dimensions may vary as per site requirements and subject to detailed design by the contracting firm.
- Detailed designs of Rainwater Harvesting Systems for individual households subject to approval of client and/or Engineer Incharge.
- Gutter sizing has been based upon the design manual of Development Technology Unit, University of Warwick
- Contractor shall prepare the shop drawings as per actual site conditions and will submit the drawing for consultant's approval prior to execution.

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PROJECT:
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ROOFTOP RAINWATER HARVESTING IN MC MURREE

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REVISIONS:

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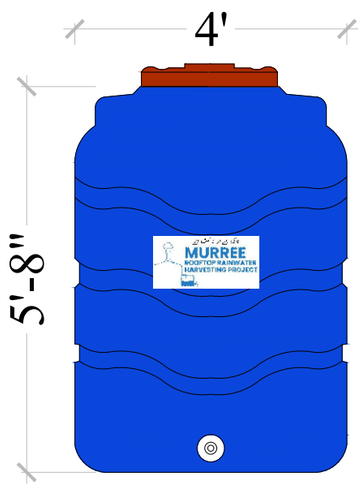
(TENDER DRAWING)

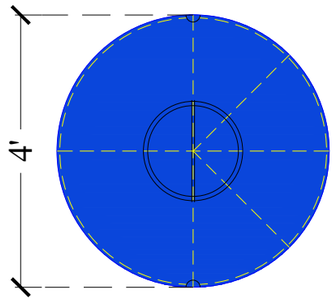
4-MARLA HOUSE

DRAWING TITLE:
GENERAL NOTES

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/02-PH	REV:
SCALE (A3):	SHEET:

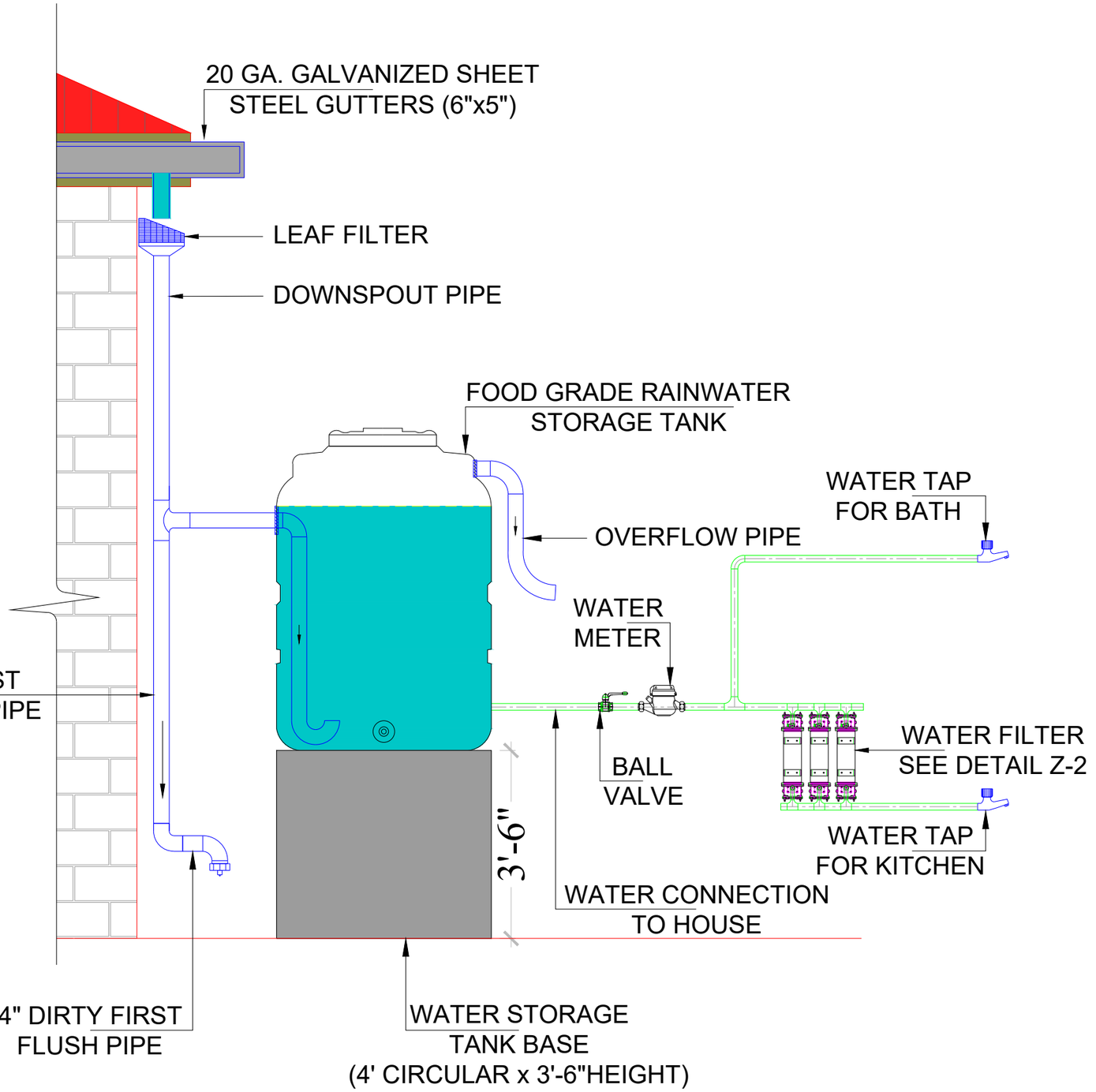


ELEVATION



PLAN

STORAGE TANK DETAIL



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PROJECT:

MURREE ROOFTOP RAINWATER HARVESTING PROJECT

ROOFTOP RAINWATER HARVESTING IN MC MURREE

NOTES:

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REVISIONS:

No.	DESCRIPTION	DATE

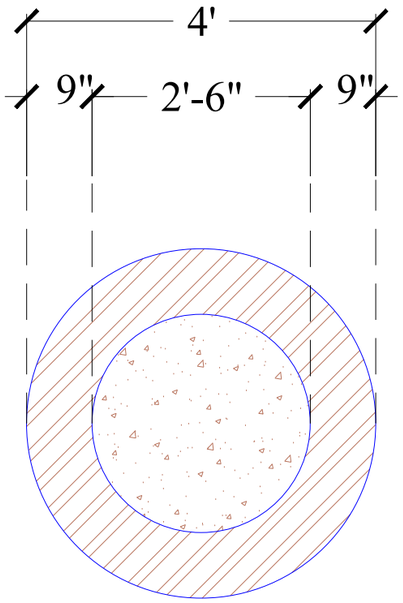
(TENDER DRAWING)

4-MARLA HOUSE

DRAWING TITLE:

STORAGE TANK PLAN FILLING AND HOUSE CONNECTION DETAIL

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/03-PH	REV:
SCALE (A3):	SHEET:



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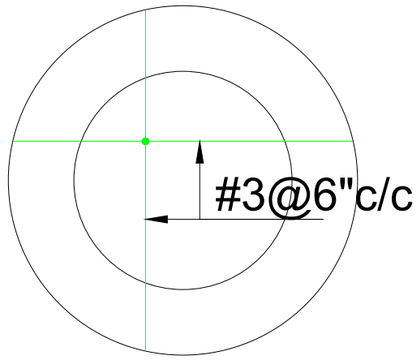

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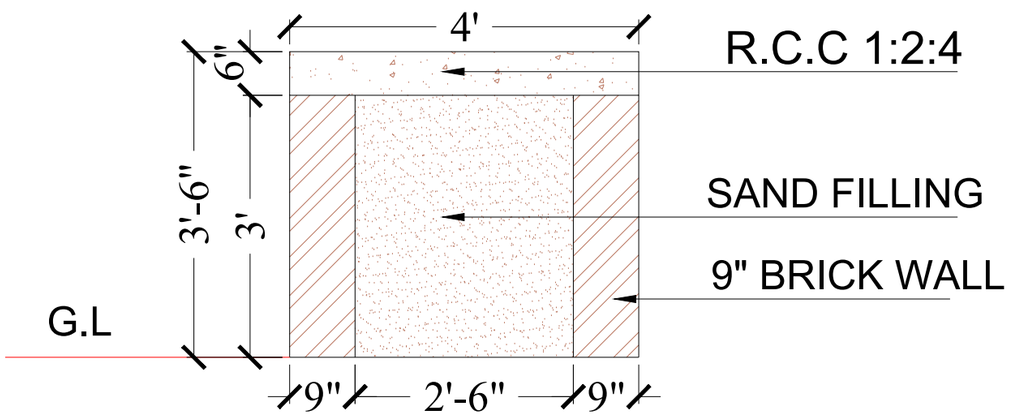
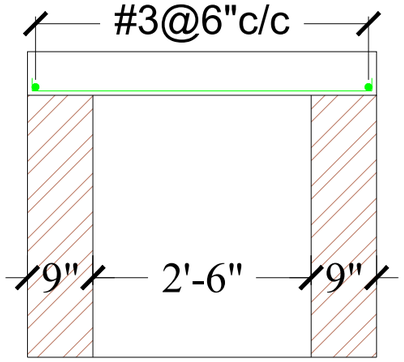


SECTION

FOUNDATION DETAIL



SECTION

REINFORCEMENT DETAIL

CLIENT:
URBAN SECTOR PLANNING AND MANAGEMENT SERVICES UNIT (PVT.) LTD.
The Urban Unit

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ROOFTOP RAINWATER HARVESTING IN MC MURREE

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REVISIONS:

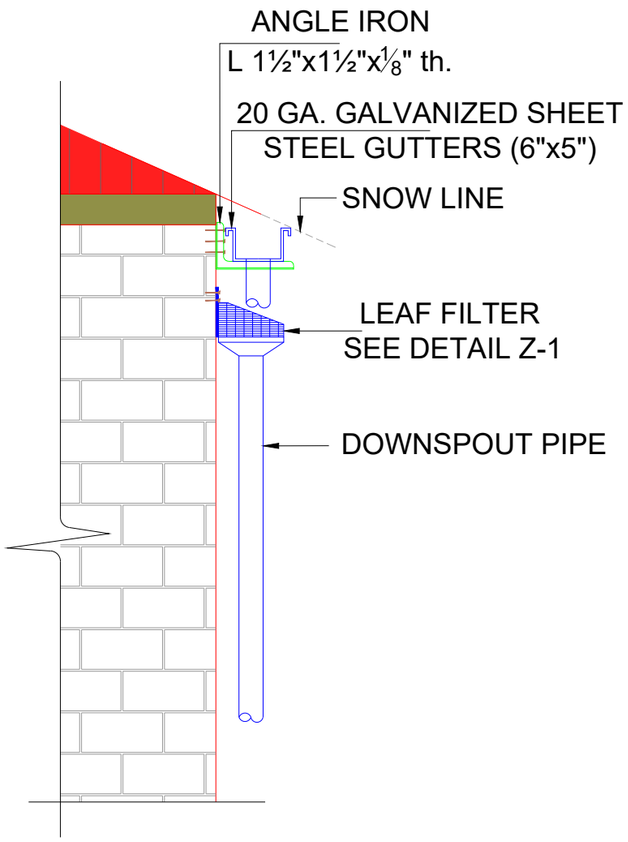
No.	DESCRIPTION	DATE

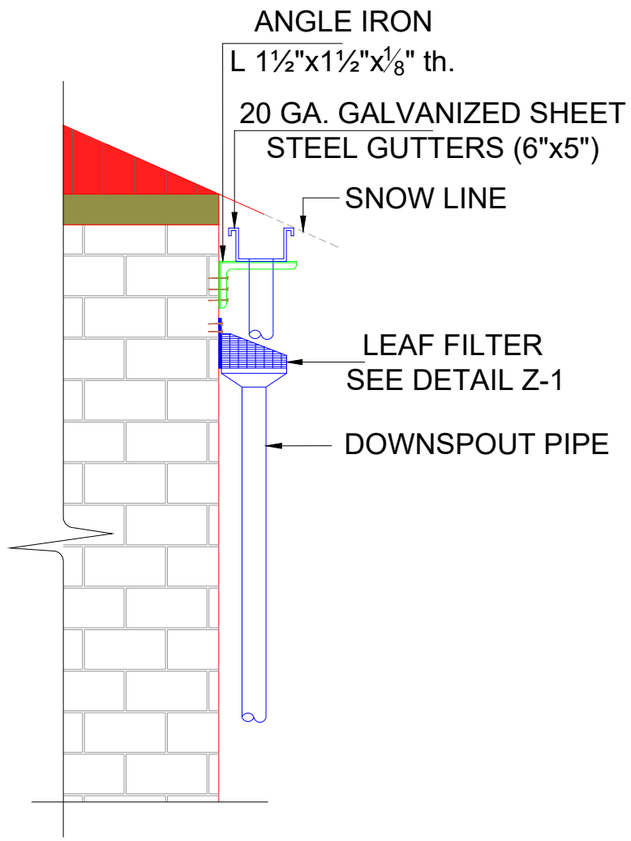
(TENDER DRAWING)

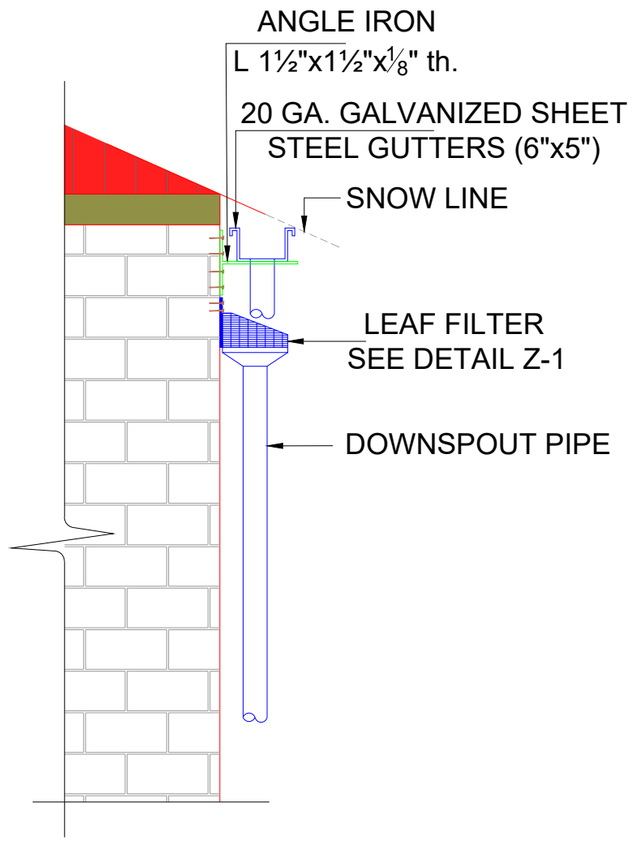
4-MARLA HOUSE

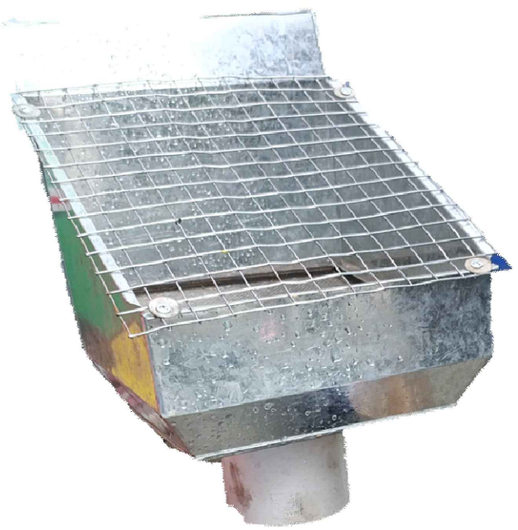
DRAWING TITLE:
TANK BASE FOUNDATION AND REINFORCEMENT DETAILS

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/04-PH	REV:
SCALE (A3):	SHEET:









LEAF FILTER DETAIL Z-1

WATER FILTER DETAIL Z-2

CLIENT:
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PROJECT:

MURREE ROOFTOP RAINWATER HARVESTING PROJECT

ROOFTOP RAINWATER HARVESTING IN MC MURREE

NOTES:

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2.

REVISIONS:

No.	DESCRIPTION	DATE

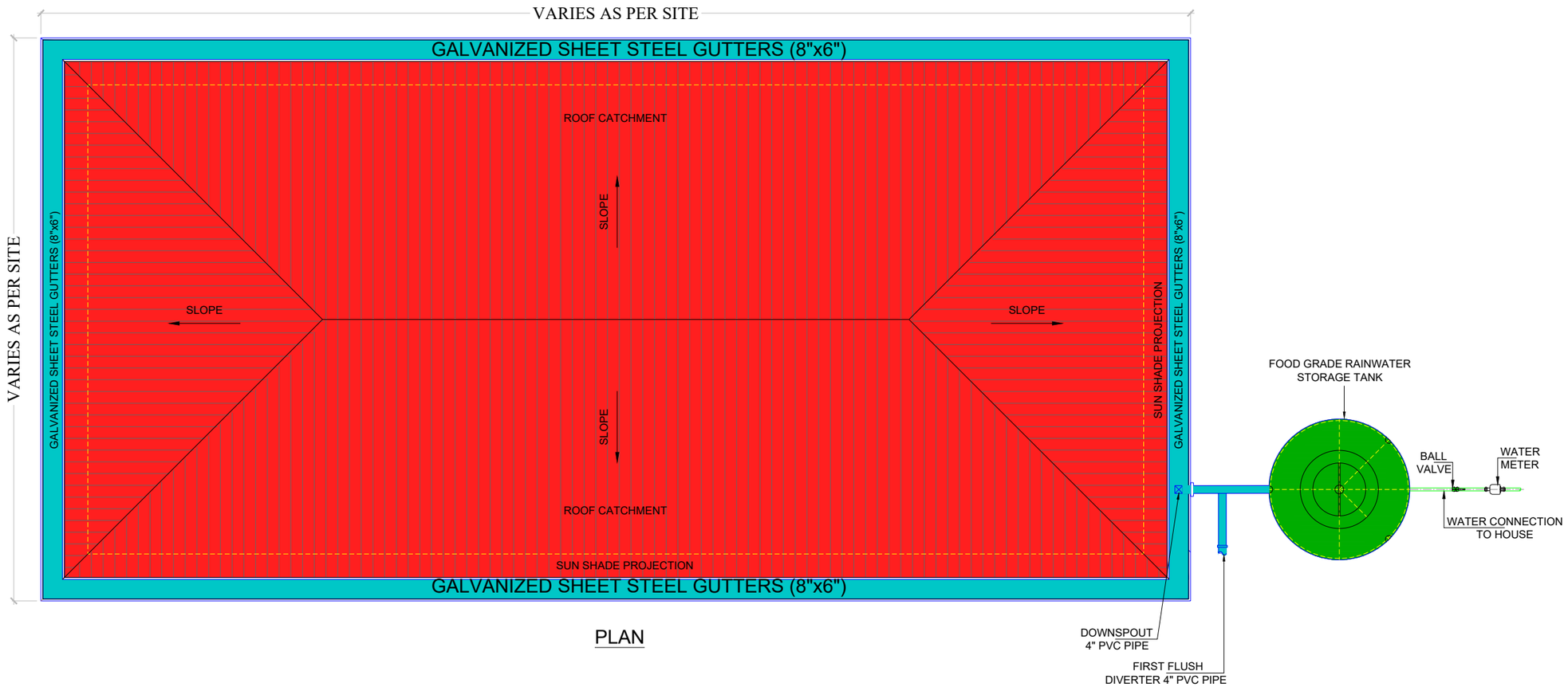
(TENDER DRAWING)

4-MARLA HOUSE

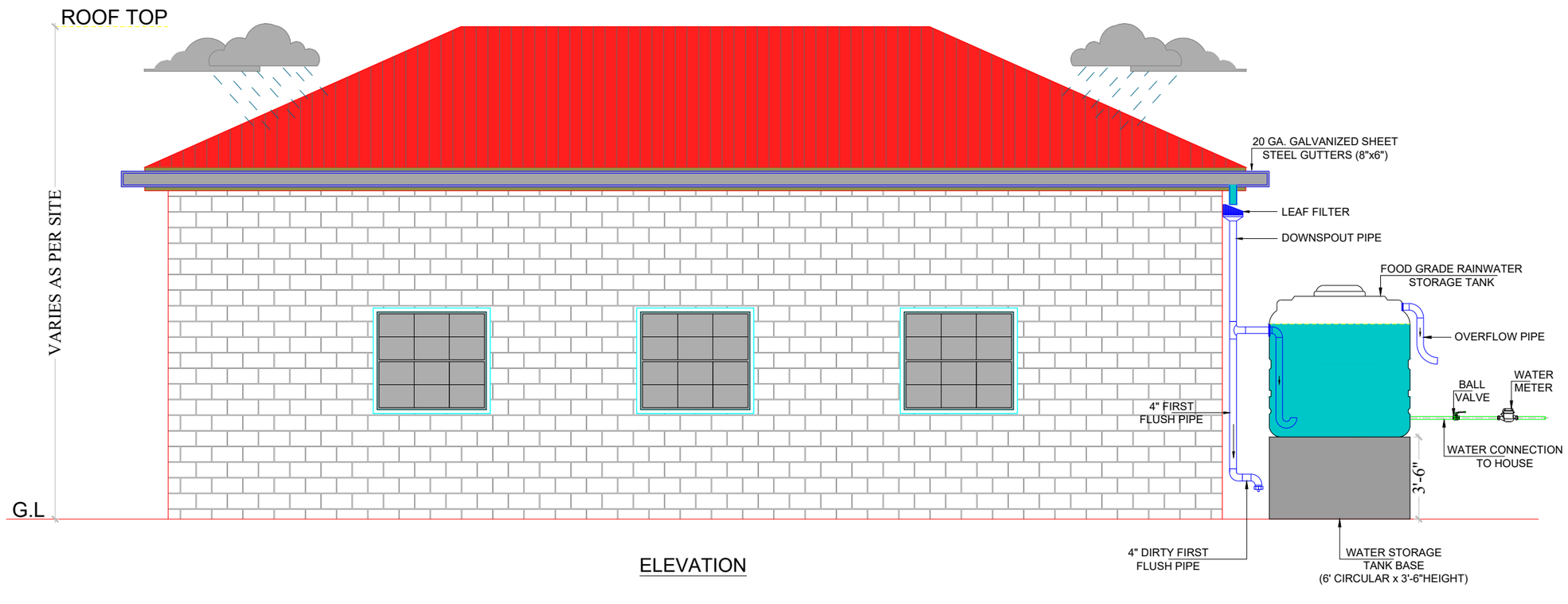
DRAWING TITLE:

MISCELLANEOUS DETAILS

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/05-PH	REV:
SCALE (A3):	SHEET:



PLAN



ELEVATION

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ROOFTOP RAINWATER HARVESTING IN MC MURREE

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REVISIONS:

No.	DESCRIPTION	DATE

(TENDER DRAWING)

5-MARLA HOUSE

DRAWING TITLE:

LAYOUT PLAN AND ELEVATION

DRAWN BY: Mr. Z	DATE: AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/01-PH	REV:
SCALE (A3):	SHEET:

FOOD GRADE RAINWATER STORAGE TANK DETAIL

NO.	MARLAS	CAPACITY (GALLONS)	DIA	HEIGHT
1	5	1000	72"	72"

SIZING OF FIRST-FLUSH DIVERTER

AREA OF PLOT	TOTAL AREA	EFFECTIVE AREA	REQUIRED VOLUME	DIA	LENGTH	VOLUME AVAILABLE
Marla	sft	sft	gallons	Inch	feet	gallons
5	1361	953	7.9	4	15	8.2

NOTE:

- Tanks dimension may vary as per individual brands and subject to approval of client and/or Engineer Incharge.
- Tank Pedestal Height may vary as per site.
- Roof dimensions may vary as per site requirements and subject to detailed design by the contracting firm.
- Detailed designs of Rainwater Harvesting Systems for individual households subject to approval of client and/or Engineer Incharge.
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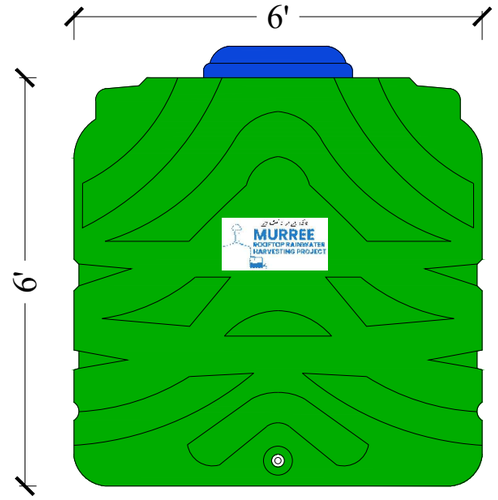
5-MARLA HOUSE

DRAWING TITLE:
GENERAL NOTES

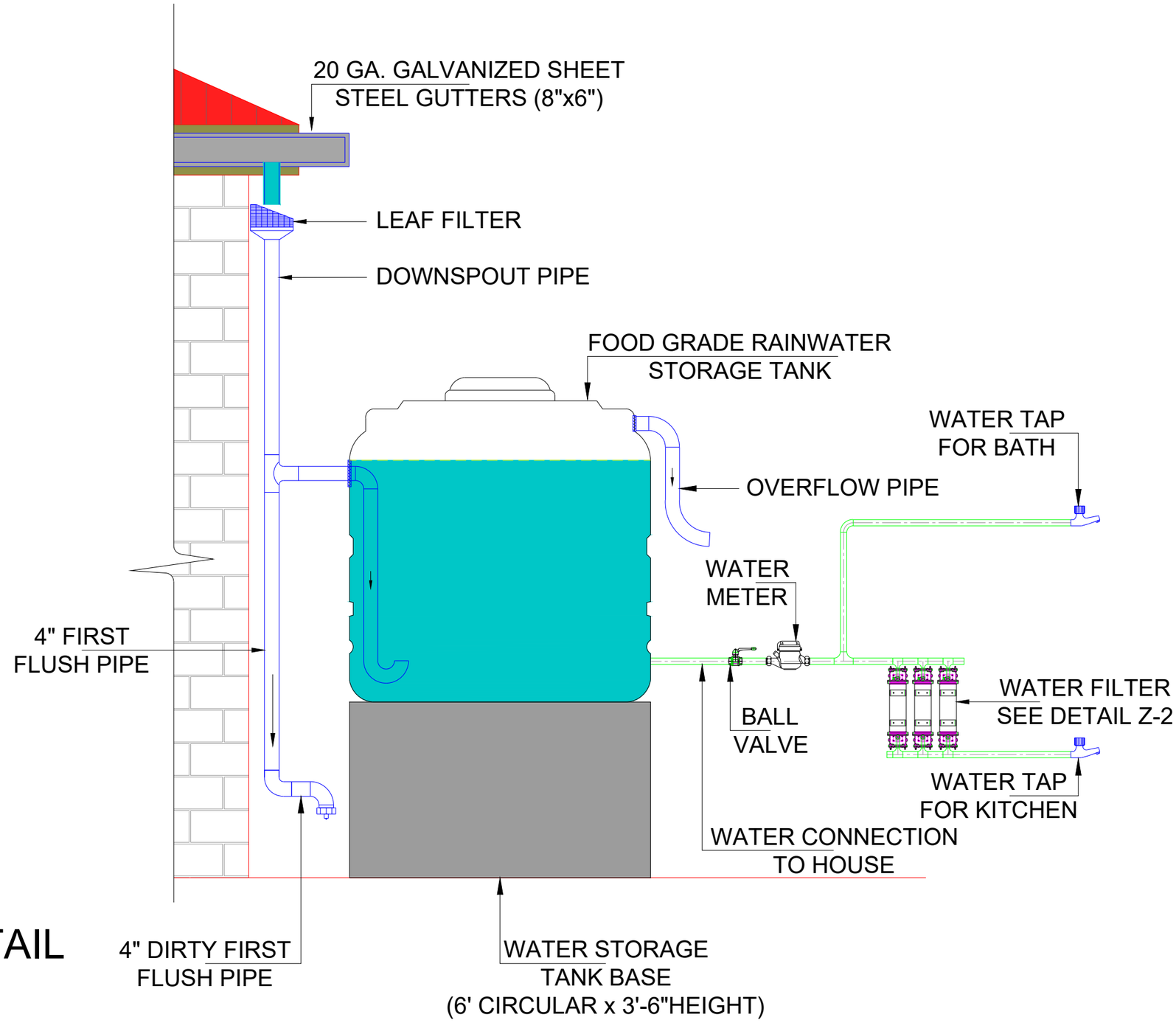
DRAWN BY:	DATE:
Mr. Z	AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/02-PH	REV:
SCALE (A3):	SHEET:



ELEVATION

PLAN

STORAGE TANK DETAIL



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REVISIONS:

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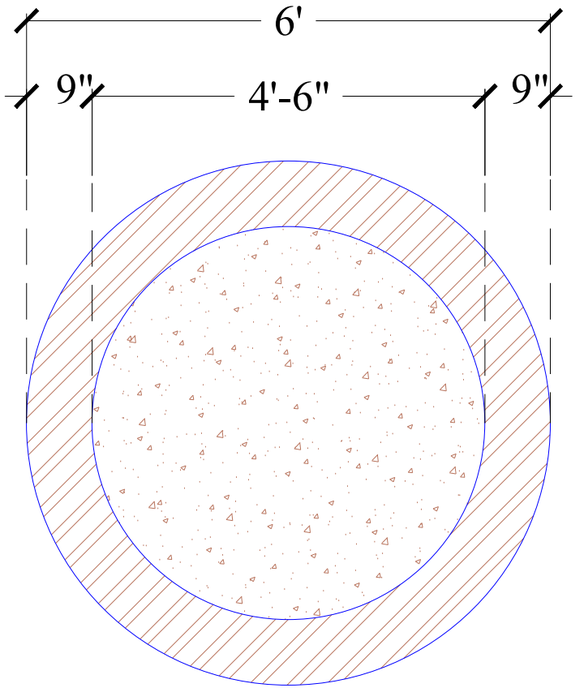
(TENDER DRAWING)

5-MARLA HOUSE

DRAWING TITLE:
STORAGE TANK PLAN FILLING AND HOUSE CONNECTION DETAIL

DRAWN BY:	DATE:
Mr. Z	AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/03-PH	REV:
SCALE (A3):	SHEET:



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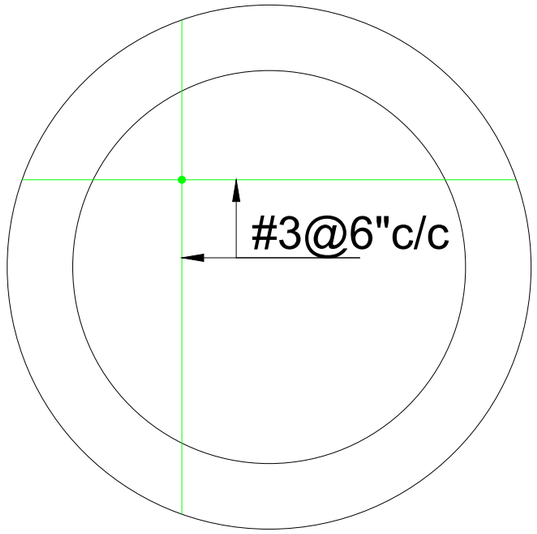

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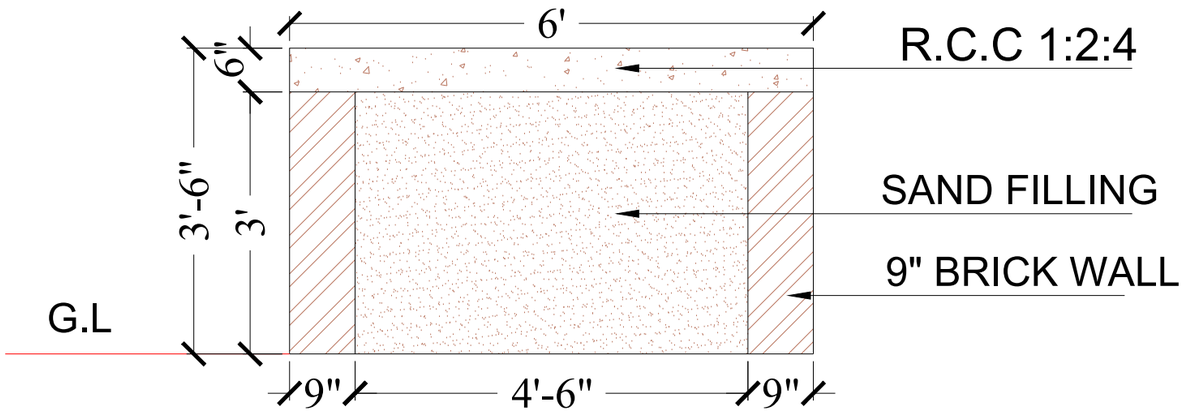
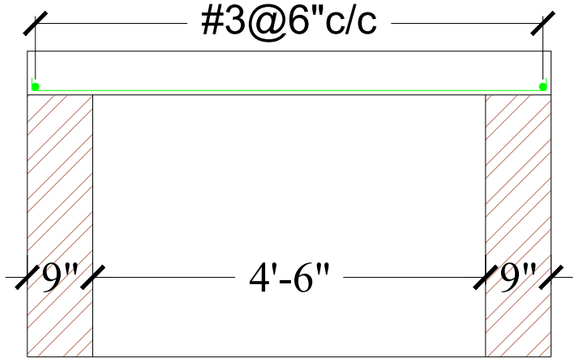


SECTION
FOUNDATION DETAIL



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REVISIONS:

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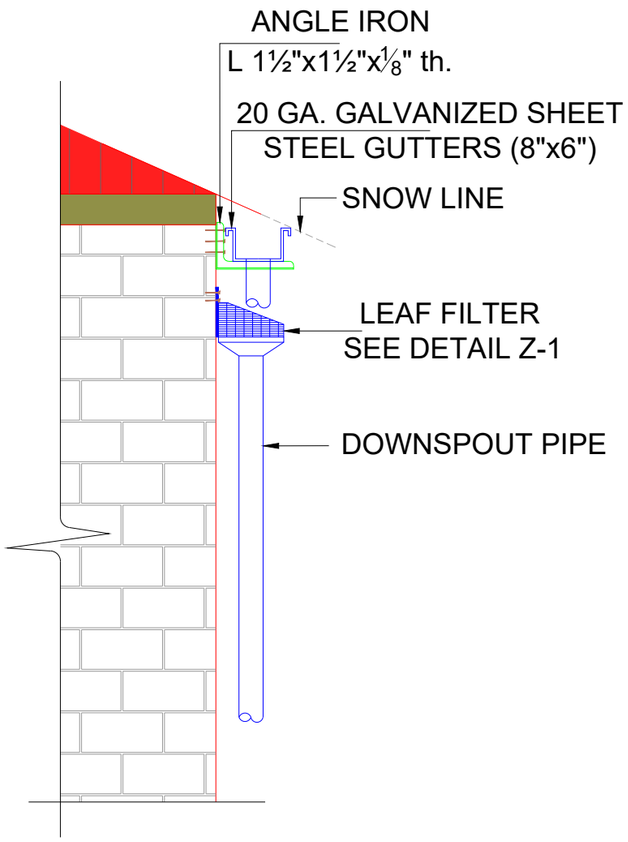
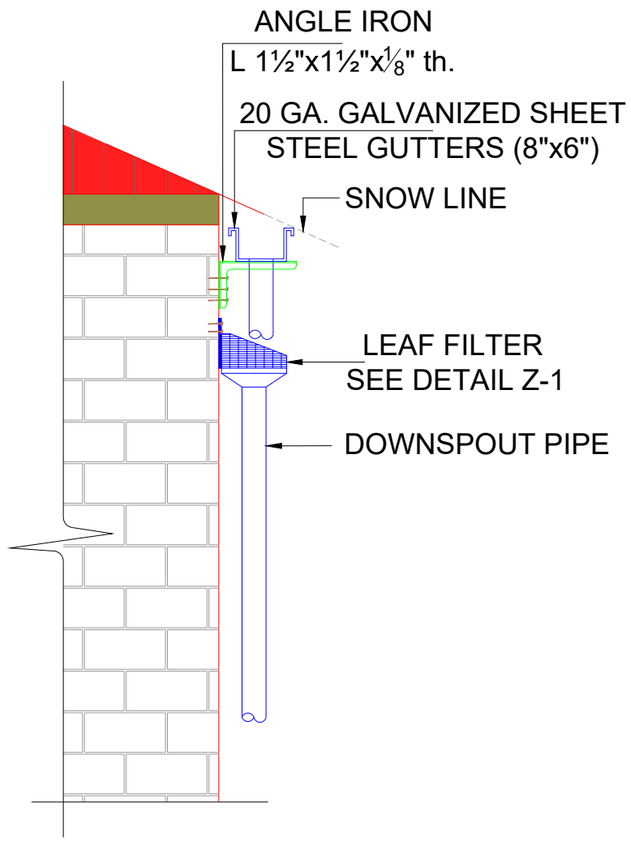
5-MARLA HOUSE

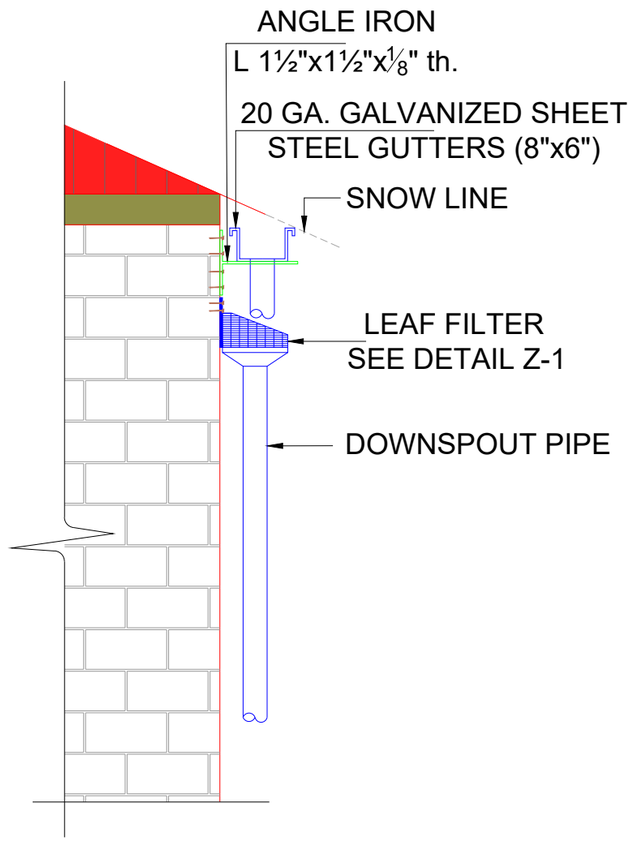
DRAWING TITLE:

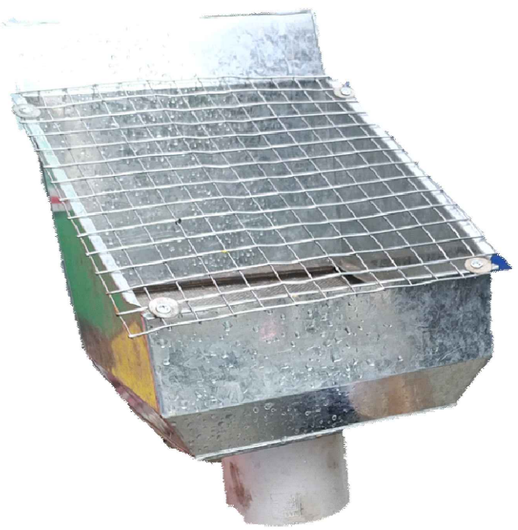
TANK BASE FOUNDATION AND REINFORCEMENT DETAILS

DRAWN BY:	DATE:
Mr. Z	AUG, 2024
CHECKED BY: Engr. W.A	
DRAWING NO: 0000/000/04-PH	REV:
SCALE (A3):	SHEET:









LEAF FILTER DETAIL Z-1

WATER FILTER DETAIL Z-2

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The Urban Unit

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2.

REVISIONS:

No.	DESCRIPTION	DATE

(TENDER DRAWING)

5-MARLA HOUSE

DRAWING TITLE:

MISCELLANEOUS DETAILS

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