

SECTION VII.

**TECHNICAL
SPECIFICATIONS**

Technical Specifications for Ancillary Equipment for Sewage and Drainage System

Bidders must indicate whether the goods and equipment offered are “Compliant” or “Non-Compliant” to the corresponding specifications prescribed by BCDA using this form.

PROCUREMENT FOR THE SUPPLY, DELIVERY, AND INSTALLATION OF ANCILLARY EQUIPMENT FOR SEWAGE AND DRAINAGE SYSTEM FOR THE NATIONAL ACADEMY OF SPORTS (NAS) – PHASE 1 AT NEW CLARK CITY											
TECHNICAL SPECIFICATIONS COMPLIANCE FORM											
NO.	QTY.	UNIT	SPECIFICATIONS	COMPLIANCE							
				Compliant	Non-Compliant						
1	1	Unit	<p>SEWAGE TREATMENT PLANT (MULTI-STAGE BIOLOGICAL PROCESS INCORPORATING BIOLOGICAL NUTRIENT REMOVAL (BNR) OR OTHER BEST PRACTICE TO REMOVE NITROGEN, PHOSPHORUS AND OTHER IMPURITIES FROM THE EFFLUENT)</p> <p>PERFORMANCE SPECIFICATIONS AND PARAMETERS</p> <p>A. The WINNING BIDDER shall supply and install the Sewage Treatment Plant, designed to meet the following:</p> <ul style="list-style-type: none"> ○ DPWH Standard Specification (Blue Book); ○ National Building Code; ○ Fire Code of the Philippines; and ○ specification and parameters described below: <p>1) DESIGN CRITERIA</p> <p>A. Process</p> <p style="padding-left: 20px;">a. The proposed treatment method will be a multi-stage biological process incorporating biological nutrient removal (BNR), considering technologies with lower unit energy consumption and reduced sludge production, or other best practice process to remove nitrogen, phosphorus, and other impurities from the effluent. Preferred BNR technologies are as follows: Fixed-Bed Biofilm Activated Sludge (FBAS), Moving Bed Biofilm Reactor (MBBR), or Membrane Aerated Biofilm Reactor (MABR).</p> <p style="padding-left: 20px;">b. Influent Characteristics</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse; width: 80%;"> <thead> <tr> <th style="width: 50%; padding: 5px;">Particular</th> <th style="width: 50%; padding: 5px;">STP</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">Average Daily Flow, m³/day</td> <td style="text-align: center; padding: 5px;">120</td> </tr> <tr> <td style="padding: 5px;">Peak Hour Flow, m³/hr</td> <td style="text-align: center; padding: 5px;">5</td> </tr> </tbody> </table>	Particular	STP	Average Daily Flow, m ³ /day	120	Peak Hour Flow, m ³ /hr	5		
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B. Sewage Characteristics

The pollutant loading from each building or facility will conform to the specified maximum permissible parameters before discharge to the sewerage system

Parameter	Maximum Permissible
BOD	300 mg/L
COD	400 mg/L
TSS	200 mg/L
TKN	35 mg/L
NH ₃	26 mgN/L
Total Phosphorus	8 mgP/L
Fecal Coliform	1x10 ⁷ /100 mL

C. Effluent Characteristics

Effluent from the wastewater treatment shall conform with the standards required under existing laws rules and regulations and shall be atleast Water Body Class C as specified in the Water Quality Guidelines and General Effluent Standards of 2016 as specified under Administrative Order 2016-08 issued by the Department of Environment and Natural Resources. The key parameters are presented below:

PARAMETER	MAXIMUM PERMISSIBLE
Ammonia	0.5 mg/L
BOD	50 mg/L
Boron	3 mg/L
Chloride	450 mg/L
COD	100 mg/L
Color	150 TCU
Cyanide as Free Cyanide	0.2 mg/L
Fluoride	2 mg/L
Nitrate as NO ₃ -N	14 mg/L
pH	6.0-9.5

Phosphate	1 mg/L
Selenium	0.04 mg/L
Sulfate	550 mg/L
Surfactants (MBAS)	15 mg/L
Temperature Change	3 oC change
TSS	100 mg/L
Oil and Grease	5 mg/L
Dissolved Oxygen (Minimum 5 mg/L)	

The characteristics and the aforementioned parameters are subject to change pursuant to any updates and/or revisions issued by DENR

D. Sewage Treatment Plant Area and Volume

The total space allocated for the proposed STP is approximately 150 m2 with a 6.5 m depth from finish ground line. Proposed location of the STP is shown in the Site Plan

E. Content of Proposals

All proposals shall include, but not limited to, the following items:

- a. The characteristics and the aforementioned parameters are subject to change pursuant to any updates and/or revisions issued by DENR.

F. Sewage Treatment Plant Area and Volume

- a. The total space allocated for the proposed STP is approximately 150 m2 with a 6.5 m depth from finish ground line. Proposed location of the STP is shown in the Site Plan.

b. Content of Proposals

All proposals shall include, but not limited to, the following items:

- i. Catalogs/brochures showing the Technical data of equipment, such as weights, physical dimensions and performance characteristics.
- ii. Plant layout showing the arrangement and dimensions of all equipment mounting.
- iii. Process flow diagram of Sewage Treatment Plant interrelated with other trades within the institutional/commercial complex.
- iv. Control and instrumentation diagrams of proposed Sewage Treatment Plant.

- v. Testing and commissioning procedures, as well as, operation and maintenance manuals for the start-up, operation, and maintenance of STP.
- vi. Complete list of chemicals to be used in the proposed Sewage Treatment Plant. Chemicals needed for the Sewage Treatment Plant must be available in the local market.
- vii. A full breakdown of plant operating and maintenance cost table on a monthly basis; assuming that the plant is treating 100%, 75%, 50% and 25% of the design flows, and also expressed as a cost per cubic meter of effluent treated.
- viii. Equipment parts list indicating the source of supply and recommended spare parts
- ix. Details of proposed installation and commissioning schedule within the framework of the Owner's schedule as in this document.
- x. Company profile showing the Contractor's background and experience including a list of past and present Sewage Treatment Plant projects done in the last five years.
- xi. Propose future facilities treatment and space requirements within the allocated space to comply with DAO2016-08 Section 11.0 Paragraph 2, No effluent shall cause the quality of the receiving water body to fall below the prescribed WQG in accordance with its Classification.

G. Compliance with DENR-EMB

- a. The complete system shall meet the requirement of the Department of Environment and Natural Resources - Environmental Management Bureau (DENR-EMB) on the quality of the effluent and all other requirements. The contractor shall obtain permit to construct and the final permit to operate the Sewage Treatment Plant.
- b. The Contractor must also obtain the discharge permit from DENR-EMB

H. Schedule of Operation

- a. Contractors are advised to consider in their proposal the commissioning, operation and maintenance (from start-up until the full capacity is utilized) starting from the acceptance of the works
- b. Design Parameters
 - i. Odourless
 - ii. Aesthetically pleasing
 - iii. Flood protected

I. Sewage Treatment Plant Component

- a. Pre-treatment: Screening and disposal
- b. Wastewater flows under gravity or is pumped (by others) to the inlet of the WWTP. Screening must be provided to remove rag and other material that

has the potential to block the plant's pumps. Screening with a maximum 6mm mesh size in two dimensions is required. An automatic system for cleaning the screen and delivering the screening to a suitable storage container for disposal shall be included. In the event of failure of the automated cleaning system, the screen shall be designed to facilitate manual cleaning. A bypass shall be included to accommodate 100% of the flow. The container for storage of rag shall be provided by the Contractor

J. Grit Removal Facilities

- a. Grit removal shall follow fine screening and storm separation and sized to handle peak design flow.
- b. The following grit removal systems can be considered for the WWTP
- c. Process selection is subject to specific site requirements:
 - i. Vortex flow separator;
 - ii. Detritus tanks;
 - iii. Settling channels; or
 - iv. Aerated grit basins
- d. The contractor shall provide mechanical grit removal together with grit withdrawal facilities and grit classifier and washer.
- e. Each mechanical grit removal unit shall have less than 50mm head loss. The design shall be capable of removing grit from raw unscreened sewage and depositing grit into the grit classifiers.
- f. All equipment shall be shipped in one piece, with pre-mounted components and provided with enclosures to prevent odour and vector nuisance. All wetted parts and screen bars shall be SS 316L as a minimum.
- g. Liquors from the dewatering compactors shall be returned to the flow by gravity or pumped if necessary. The liquors shall be returned upstream of the screens.
- h. The conditioning and cleaning of screened material and grit is undertaken such that no visual fecal matter and that the screenings are in a suitable condition for road transport and ultimate offsite disposal.
- i. The Contractor shall provide suitably sized and an appropriate number of skips at least 1 skips per units for coarse screenings, fine screenings and grit chamber to facilitate the collection and transfer of screenings and grit from site. The Contractor shall undertake skip transfer frequently, and dispose waste materials generated daily or as directed by the Employer. The Contractor shall ensure that the management of skips is appropriate to the amount of waste anticipated
- j. The skips as a minimum are required to be covered in order to reduce the potential level of odor

generation on site and prevent the collection of water in them.

- k. Penstocks shall be provided upstream and downstream of the grit chambers, so that each of them can be isolated during maintenance servicing

K. Fat, Oil and Grease (FOG) Removal System

- a. FOG removal is typically combined with grit and screenings removal system.
- b. Mechanical emulsified oil and grease removal unit shall be provided if the FOG concentration of the influent wastewater is excessively high. It may be provided to protect downstream equipment / processes where:
 - i. Lamella plate settlers are used at downstream processes.
 - ii. Influent FOG concentration is high (e.g.> 100 mg/L on average)
- c. The design capacity shall be able to treat the design peak flow.
- d. FOG separation by diffused air is preferred.
- e. Effective FOG removal mechanism shall be provided. Removed FOG can be sent to sludge holding tanks for further treatment in anaerobic digesters), where applicable, unless inhibitory substances exist.
- f. The removal of emulsified oils and greases shall be performed before the equalization tank to minimize the build-up of oil and grease in the equalization tank.
- g. The collected emulsified oils and grease shall be mixed with the sludge for treatment and handling.
- h. To protect downstream processes, emulsified oils and grease shall be removed prior to any biological treatment.
- i. Oil and grease levels entering the sewage are anticipated to be highly variable in concentration and will consist of free oil and grease as well as emulsified oil and grease

L. Wastewater treatment

- a. The Fixed Bed Activated Sludge (FBAS) treatment technology is the preferred technology as secondary biological treatment process. However, other similar technologies can be offered as long as that it will have a better CAPEX and OPEX compared to FBAS technology. The offered technology will be designed and installed to meet the requirements of this Performance Specification, especially the effluent quality standard.
- b. Wastewater treatment will remove the required amount of BOD, ammonia, nitrogen, phosphorus, and other impurities to ensure the effluent quality specified in DENR Class C is met. The wastewater treatment plant is required to comply with both nitrogen and phosphorus removal requirements by

denitrification in the anoxic zones of the activated sludge system.

- c. Secondary treatment of the WWTP can be a combination of attached growth (fixed film), suspended growth, hybrid biological processes, or other innovative treatment technology designed to consistently meet the performance and effluent requirements. Proposed technologies shall have proven records to work in previous projects undertaken. BCDA has the option to inspect previous projects performance for confirmation. Any false representation in the bid shall be ground for disqualification by the Bidder.
- d. Consistent with the requirement for optimized design, the contractor shall be responsible for setting the optimum hydraulic profile, the optimum number of modules/trains and the optimum dimensions of the different components based on optimum design parameters such that the effluent quality is met at minimum life-cycle cost of the plant.
- e. Each aeration tank shall be provided with online monitors for DO, MLSS, TSS, pH, and temperature.
- f. The design shall include means of draining down all basins or tanks one at a time for maintenance purposes. All sewage removed during a drain down shall be returned to a point in the process where the load can be evenly distributed to the basins in service to prevent shock loading. The draining facilities shall be capable of draining a basin fully within forty-eight (48) hours.

M. Final Sedimentation

- a. This is required to produce a clear effluent and to ensure that the total suspended solids meets the discharge standard.

Table 1. Final Sedimentation Technologies

SECONDARY TREATMENT TECHNOLOGIES	SOLIDS SEPARATION (TYPICAL)
Fixed-Bed Biofilm Activated Sludge (FBAS)	Secondary Clarifier, Disc Filter
Moving Bed Biofilm Reactor (MBBR)	DAF, high rate filter, Secondary Clarifier
Integrated Fixed Film Activated Sludge (IFAS)	Secondary Clarifier
Advance Oxidation Process	Discharge Filter

N. Secondary Clarifier

- a. For biological treatment processes, the secondary clarifier shall be designed using values of design parameters that are consistent with the design of the aeration tank, especially the sludge retention time and the mixed liquor suspended solids. The sizing must consider also the costs of sludge storage, dewatering and disposal. In short, the design of the secondary clarifier should consider the life-cycle costs of the upstream and downstream components.

O. Disc Filter

- a. For biological treatment processes, disc filters shall be fully enclosed, free-standing units or may be semi-submerged units located in a covered tank. The filter will consist of a series of rotating discs which will be partially submerged in the plant flow through the disc filter tank. Each disc filter unit will be sized for ADWF and have capacity for peak flows. Level monitoring using ultrasonic level gauges is preferred but alternate means of level detection will be considered.
- b. The backwash operation will use treated wastewater. Each unit will be equipped with a dedicated backwash pump (if necessary, i.e. assuming that recycled waste water pressure is below a required pressure) per filter and sprayed on the non-submerged portion of the filter elements. Backwashed sludge will be discharged to the sludge holding tank.

P. Disinfection

- a. Disinfection may be required to reduce pathogens prior to release to the environment. The Contractor shall demonstrate their proposed method of disinfection control, to ensure that overdosing is not a risk, and that downstream ecology is not adversely affected. The Contractor shall state the pathogen log removal offered by the supplied wastewater treatment plan. For biological treatment processes, disinfection shall be included as a final step in the treatment process.
- b. UV disinfection shall be provided as required to meet the overall pathogen reduction specified in the effluent discharge requirements and/ or reuse requirements.
- c. Chlorination disinfection and UV are required, with UV taking precedence.

Q. Effluent Discharge

- a. After treatment, the effluent shall discharge by gravity from the contact tank above the maximum flood level. Discharge of final effluent from the wastewater treatment plant to water bodies shall comply with current applicable DENR and other relevant national standards.

R. Sludge Management

- a. Sludge will be collected in a holding tank where it will be kept in aerated and agitated condition using

diffused aeration system. Sludge dewatering shall be accomplished by mechanical means and will not occur in sludge drying beds or lagoons. Dewatered sludge shall be transferred to covered skips or similar and the Contractor will be responsible for conveyance off-site to an approved disposal location

- b. The Contractor will be responsible for conveyance offsite to an approved disposal location.

2) Buildings

- A. All buildings such as administration/laboratory, air blowers building, chemical building and dewatering facility building shall follow the Philippine Building Code. All buildings shall be provided with proper lighting, ventilation, air conditioning, noise barriers, etc. that may be required for the smooth operation of the building.
- B. Piping and Valves
 - a. Materials for pipelines shall be resistant to corrosive attack and mechanically satisfactory for the duty.
 - b. Preferred pipe materials are as follows:
 - i. Sewage transmission
 - ii. Reinforced concrete
 - iii. Sewage network HDPE
 - c. Pipe pressure ratings shall be determined according to test and working pressure requirements for the design flow at the end of the concession period.
 - d. All valves required for operation of the utility infrastructure shall be provided by the Contractor and where applicable integrated with the SCADA system. Such valves will include isolating valves, air valves, washout valves, and pressure regulating valves
- C. Duty and standby equipment items shall be equipped with an isolating valve at the feed and outlet to enable removal for off-line maintenance.
- D. Monitoring Devices
 - a. pH and DO probe with indicators shall be installed at the equalization tank and aeration tanks for monitoring purposes.

3) Sewage Treatment Plant Equipment

- A. General
 - a. Under this section, mechanical equipment will include the furnishing, installation, and testing under operational conditions, of all items required by the STP. Insofar as possible and practicable, equipment items will be standard units of reputable manufacturers regularly engaged in the design, fabrication and testing of their product preferably from the United States of America, Japan, Europe, Israel, Singapore and the like. These specifications stipulate that the contractor shall engage the services of competent personnel to test the installed equipment and to acquaint and train the treatment plant personnel on operation and maintenance procedures. Country of origin is a matter of preference. Others of similar quality and reliability may be considered,

especially if they are licensed manufacturers from preferred source.

- b. Unless otherwise specified, contractors shall provide two sets of electro-mechanical equipment with one set normally operating and the second set serving as stand-by.

4) Equipment

- A. Lift Pumps: Furnish and install at least two (2) sets of Lift Pumps with adequate capacity to handle the daily sewage flow. Each lift pump shall have the capacity equivalent to average flow.

Pump casing, shaft, impeller, bearing, housing, pump pedestal, and motor pedestal will be fabricated of materials suitable to handle wastewater and resistant to corrosive environment. Lift pumps shall originate preferably from the United States of America, Japan, Europe, Israel, Singapore and the like and should be factory assembled. Country of origin is a matter of preference. Others of similar quality and reliability may be considered, especially if they are licensed manufacturers from preferred source.

- B. Bar screen: The influent box shall be furnished with a removable stainless steel bar screen and the necessary fasteners for connecting to the plant influent box.
- C. Aeration system: Furnish and install a complete aeration system designed to provide adequate aeration for the daily design sewage flow. The aeration equipment shall consist of removable components or sub-assemblies made of corrosion-resistant material for easy maintenance and shall be equipped with a regulating valve for adjusting or shutting off air flow.
- D. Air Supply System: For biological treatment processes, the air requirement of the plant shall be supplied thru three (3) rotary positive displacement blowers of identical capacities. The capacity of each blower shall be fifty percent (50%) of the total air requirement at the ultimate design flow.

Each blower shall be provided with an inlet filter, silencer regulator to vary the air output, a weighted type air relief valve and shut-off valve. Blower shall originate preferably from the United States of America, Japan, Europe, Israel, Singapore and the like. Country of origin is a matter of preference. Others of similar quality and reliability may be considered, especially if they are licensed manufacturers from preferred source.

- E. Secondary Clarifiers: For biological treatment processes, secondary clarifiers must be designed to produce an effluent TSS concentration not greater than 100 mg/L to effectively reduce total phosphorus to below 1.0 mg/L. Sidewater depth should be designed such that the clarifier can be operated with minimal upflow velocity through the sludge blanket. Clarifier shall be equipped with automatic scraping and desludging devices. Flow distribution

channel/chamber shall be provided for flow isolation or to equalize the flow distribution.

For shorter detention time for settling sludge and to accommodate in-tank flocculation chamber, circular clarifiers are preferred. Lamella plate clarifiers may also be used provided it has a higher efficiency than the circular clarifiers

F. Chlorination: Furnish and install an automatic chlorinator capable of delivering the required dosage of solution in a variable sewage flow condition. The equipment shall be equipped with discharge tubing, motor, sensor/transmitters, chlorine solution tanks and chlorine solution tanks and chlorine residual analyzers for chlorine residual monitoring.

G. Test Kit: Furnish with the plant a portable test kit to include the necessary equipment and chemical reagents to determine dissolved oxygen, settleable solids, relative stability and hydrogen ion concentrations (pH). The kit shall be provided with instructions/manual for performing the analysis. The equipment and reagents shall be completely contained in a portable container with a hinged cover and carrying handle.

5) Motors

A. General Requirements

- a. Motors shall be furnished with driven equipment to assure proper coordination of motor and control characteristics with requirements of driven equipment. Contractor is responsible for proper correlation of horsepower, starting torque, other characteristics of electrical equipment with requirement of driven equipment.
- b. All necessary accessories essential to the proper operation of the motor and the driven equipment shall be provided

B. Miscellaneous Metal Works

- a. Miscellaneous metalwork including pipe handrails, grating supports, ladders, rung, seat angles, guards, stop gates and guides, weir plates, launders and through, pipe hangers and supports, anchor bolts, and all required anchors and appurtenances, shall be stainless steel 316.

C. General Conditions

- a. All sections under this Division shall be subject to the requirements of the Department of Environment and Natural Resources and Environmental Management Bureau.
- b. The term Contractor in these Specifications shall mean the Contractor for the Sewage Treatment Plant.

D. General Description

- a. The work to be done shall consist of the design, supply and installation, complete in all details, of the Sewage Treatment Plant Works, at the subject

			<p>premises, and all work and materials incidental to the work that are expressly stated to be done by others.</p> <ul style="list-style-type: none"> b. All work shall be in accordance with the governing Codes and Regulations and with these Specifications, except where same shall conflict with existing codes, etc., in which latter shall then govern. c. The requirements with regards to materials and workmanship specify the required standards for the furnishing of all labor, materials and appliances necessary for the complete installation of the work specified herein and indicated on the drawings. These specifications are intended to provide a broad outline of the required installation, but are not intended to include all details of design, supply and installation. d. The Contractor shall adopt his proprietary technique to guarantee the safety and performance of the system in accordance with the concepts and criteria set by these Specifications. The Contractor must be experienced in Sewage Treatment Plant works. e. No consideration will be granted for any alleged misunderstanding on the quality of materials to be furnished or work to be done, it being understood that the submission of a proposal is an Agreement to all items and conditions referred to immediately place an order as soon as the project is awarded to him. Any exceptions, omission or substitutions shall be presented in writing with the Contractor's Bid. f. The Contractor, before commencing work, shall examine the proposed location of the STP and all adjoining areas on which this work is in any way dependent for perfect workmanship according to the intent of these specifications and shall report to the Owner's representative any condition which will prevent the Contractor from performing first class work. No waiver of responsibility for defective work will be considered unless notice has been filed at the time the Contractor submits his proposal. <p>E. Work Included</p> <p>Under this Division of the Specifications, provide all materials and equipment and perform all the work necessary for the complete execution of all Sewage Treatment Plant (STP) works as herein specified, except as otherwise but not be limited to the following principal items of work:</p> <ul style="list-style-type: none"> a. Furnishing, delivery to the project site and installation of complete Sewage Treatment Plant including all equipment, valves, and piping, motor and controls and all accessories necessary to complete the system. b. Preparation of installation drawings and design calculations of the above STP including selection of mechanical equipment capacities, design of tank dimensions, piping and all accessories to comply with the concepts and criteria set by these Specifications. c. Electrical Controls of the above systems including motor control center, remote control switches, motor 		
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			<p>controllers and starters, wires and cables, conduits and other required accessories.</p> <ul style="list-style-type: none"> d. Sanitary sewer connection of effluent pipe from STP to the main sanitary sewer system. e. Corrosion protection and painting of all equipment and piping including all exposed and embedded materials. f. Interim Operations and Maintenance, and Complete testing and commissioning of the entire Sewage Treatment Plant, satisfying dry and wet conditions, including supply of all instruments for operating and testing the various systems and submission of reports. g. Full instruction after completing the job to the maintenance personnel regarding operation and maintenance of the entire installation. Provide complete printed/typewritten instruction booklets (hardbound) covering maintenance, operation and adjustments of each piece of equipment and list of spare parts for each piece of equipment. h. If anything has been omitted in any item of work or materials usually furnished, which are necessary for the completion of the STP Work as outlined herein before, then such items must be and are hereby included in this Division of the Work. i. Acquisition of Authority for Discharge Permit, and Permit to Operate from DENR. j. Prepare Environmental Impact Assessment (EIA) and other documentary requirements and facilitate the application until issuance of Environmental Compliance Certificate. k. Coordinate and facilitate service application to Shin Clark Power Holdings Incorporated for Primary or Secondary metering and costs for any specialty voltages, frequencies, DC (if required) that should include the necessary transformers, rectifiers, inverter/converter for a stable operation. l. Coordinate and facilitate water service application with Primewater Tahal PAVI MGS Corporation. m. The Contractor shall prepare all plans, applications, permits, etc., and shall complete all tests, forms, etc., required by all rules, regulations, etc. of all the Government Authorities having jurisdiction and such shall be completed by personnel of proper caliber, in particular engineers, where so required <p>F. Codes, Inspections, Permits and Fees</p> <ul style="list-style-type: none"> a. The work under this Contract is to be installed according to the latest applicable codes, ordinances and requirements of the following: <ul style="list-style-type: none"> i. National Plumbing Code of the Philippines ii. Sanitation Code of the Philippines iii. Department of Health iv. Department of Agriculture v. Effluent Regulations of 1990 – Environmental Management Bureau (EMB) formerly National Pollution Control Commission (NPCC) 		
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- vi. Rules and Regulations of the EMB for Domestic and Industrial Wastewater Disposal (Section 6g of Presidential Decree No. 984, otherwise known as the National Pollution Control Decree of 1976)
- vii. DENR Administrative Order (DAO) 2016-08
- viii. DENR Administrative Order (DAO) 2021-19
- ix. NCC Design Standards and Guidelines
- x. NCC Minimum Performance Standards and Specifications for Water and Wastewater Infrastructure

The Contractor's bid shall be deemed to include all costs to comply with the various code, inspections, permits and fees

Nothing contained in this Specification shall be construed as to conflict with National and Local Ordinances or Laws governing the installation of Sewage Treatment Plant Work and all such laws and ordinances are hereby made part of this Specification. The Contractor is required to meet the requirements hereof.

- b. Codes and Standards of following organizations other than mentioned above are referenced in this Specification. The Contractor's price shall be deemed to include compliance with the following:
 - i. American National Standards Institute (ANSI)
 - ii. American Society for Testing and Materials (ASTM)
 - iii. American Water Works Association (AWWA)
 - iv. International Organization for Standardization (ISO)
 - v. National Electrical Manufacturers Association (NEMA)
 - vi. Underwriters' Laboratories (UL)
 - vii. Uniform Plumbing Code by IAPMO
 - viii. U.S. Federal Specifications (FS)
- c. All construction permits and fees required for this work shall be obtained by and at the expense of the Contractor. The Contractor shall furnish the Architect, the Engineer and the Owner final certificates of inspection and approval from the proper government authorities after the completion of the work.

6) Record Drawings

- A. The Contractor shall, during the progress of work keep record of all deviations of the actual installation from that shown in the approved Installation Drawings.
- B. Upon completion of work, the Contractor shall submit two (2) copies of the as-built drawings, signed and dry-sealed by the Contractor's registered sanitary engineer, indicating the work as actually and finally installed, including new information not originally shown in the approved Installation

Drawings, to the Engineer for approval as to conformance with these Specifications and compliance with pertinent Code provisions. The Contractor shall also submit two (2) sets of operating and maintenance instructions, equipment and parts lists for approval.

- C. After such approvals, the Contractor shall submit the as-built originals (sepia) and two (2) sets of prints to the Owner, as well as three (3) sets of operating and maintenance instructions, equipment and part lists, including addresses of manufacturers or suppliers of major equipment and materials.
- D. Approval of the as-built drawings by the Engineer shall be a requirement for final acceptance of the completed works and for final payment.

7) Installation Drawings and other Submittals

- A. The Contractor shall prepare and submit for approval the following:
 - a. Dimensional layout drawings of the Sewage Treatment Plant and its auxiliary equipment, pumping and piping systems, concrete tanks, control system and other systems which are complete in nature, or which require close coordination with other work of this trade and/or the work of other trades.
 - b. Calculation of sewage treatment processes, equipment sizing and selections, and other processes involved in the preparation of proposed construction of the Sewage Treatment Plant.
 - c. Dimensional drawings of all concrete tanks and other structures required in the review of structural design.
 - d. Electrical control components to include MCC's, starters, breakers, wires, etc.
 - e. Complete control schematic and wiring diagrams for all equipment.
 - f. Manufacturer's catalog sheets, marked as necessary to indicate materials or equipment being furnished for the following:
 - i. Pumps, blowers and other STP equipment complete with ratings and dimensions
 - ii. Controls, magnetic starters, pressure switches, valves, etc.
 - iii. Valves: Gate, check and pressure reducing valve
 - iv. Pipes and fittings
 - v. Flexible couplings
 - vi. Riser supports, hangers and sleeves
 - g. Marked sets of piping drawings showing mark number and exact location of hangers, anchors, guides and sway braces, and approximate location of random hangers.
 - h. Details of all anchors, guides and sway braces.
 - i. List of miscellaneous materials proposed, including pipe, fittings, valves, etc., and manhole accessories, identifying manufacturer and type
 - j. Field test reports
 - k. Such other drawings as the Engineer may require

- B. All drawings should be signed and dry sealed by the Contractor's Registered Sanitary Engineer, Structural Engineer and other Professional Engineers concerned.
 - C. All drawings, etc., shall be submitted sufficiently in advance of field requirements to allow ample time for checking and no extension of the contract time will be granted this Contractor, by reason of his failure in this respect.
 - D. All submittals shall be complete and shall contain all required information and details.
- 8) Coordination
- A. Coordinate schedule of installation with works of other trades.
 - B. Systems provided shall be complete and operable, and shall include required accessories, fastenings and supports.
 - C. All equipment shall be installed in strict accordance with manufacturer's recommendation.
 - D. Coordinate and facilitate with the necessary stakeholders and Government agencies for the implementation and operation of the Project.
- 9) Guarantee
- A. The Contractor shall guarantee the Sewage Treatment Plant's complete and successful operation against defects on the equipment and defects in workmanship for a period of two (2) years from date of completion of the Contract certified by the Architect. Said warranty shall include repair works and labor.
 - B. The Contractor shall guarantee the performance of the STP for one (1) year in terms of complying with the required effluent characteristics as stated in Section 3.4 Effluent Characteristics.
 - C. All equipment furnished and installed shall be new and free of defects in design materials and workmanship. The Contractor shall replace, without additional cost to the Owner, any defective material or equipment within two (2) years after final acceptance of the plant.
 - D. Replacement of defective components, labor to troubleshoot or repair of the systems shall be furnished by the Contractors at no charge to the Owner during the guarantee period.
 - E. The Contractor shall indemnify and save harmless the Owner and the Engineer from and against all liability for damages arising from injuries or disabilities to persons or damage to property occasioned by any act or omissions of Contractor or any of his Sub-Contractors, including any and all expenses, legal or otherwise which may be incurred by the Owner or the Engineer, in the defense of any claim, action or suit.
- 10) Workmanship
- A. The work throughout shall be executed in the best and most thorough manner to the satisfaction of the Architect and the Engineer who will jointly interpret the meaning of

			<p>the Drawings and Specifications and shall have power to reject any work and materials which in their judgment are not in full accordance therewith.</p> <p>The Contractor shall assume full responsibility for the design, supply, installation, testing, commissioning and hand-over of Sewage Treatment Plant and guarantee its satisfactory performance.</p>		
2	1	Unit	<p>500 GPM FIRE PUMP</p> <p>A. Flow Rate = 500 gallons per minute B. Total Dynamic Head = 289 FT. C. BHP = 75 Horsepower D. Voltage = 400 V E. Phase = 3 P F. Hertz = 60 Hz G. Electrically and mechanically interlocked H. With complete controller & accessories</p> <p>1) GENERAL REQUIREMENTS FOR CENTRIFUGAL FIRE PUMPS</p> <p>A. Description: Factory-assembled and -tested fire-pump and driver unit. B. Base: Fabricated and attached to fire-pump and driver unit with reinforcement to resist movement of pump during seismic events when base is anchored to building substrate. C. Finish: Red paint applied to factory-assembled and -tested unit before shipping.</p> <p>2) HORIZONTALLY MOUNTED, MULTI-STAGE SPLIT-CASE FIRE PUMPS (BY OTHERS)</p> <p>A. Manufacturers: Subject to compliance with requirements, provide available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:</p> <ol style="list-style-type: none"> a. Provide packaged type fire pumps and jockey pump system, all assembled on a common base-plate. All components shall be FM approved listed where applicable, and in accordance with the following specifications. b. Refer to Schedule for duty. Provide horizontal multi stage, split-case centrifugal pump, hydrostatically tested to twice the maximum working pressure. Provide ductile iron casing and cover with cast iron motor bracket, bronze impeller and wearing ring, and bronze shaft sleeve. Connected to a 3,600 rpm (max), solid shaft, open drip proof type motor. c. Provide pumping unit complete with the following accessories: <ol style="list-style-type: none"> i. One (1) concentric increaser, attached to the fire pump discharge complete with 20 mm automatic air release valve and 20 mm circulation relief valve set approximately 10% above operative discharge pressure ii. One (1) FM approved and labelled fire pump control panel, and with a circuit breaker 		

			<p>interrupting capacity amperes RMS symmetrical of two (2) complete with pressure switch suitable for 350 psi range</p> <p>B. Standard: FM approved, for split-case pumps for fire service</p> <ul style="list-style-type: none"> a. Number of Stages: Two b. Casing: Axially split case, cast iron with ASME B16.1 pipe-flange connections c. Impeller: Cast bronze, statically and dynamically balanced, and keyed to shaft d. Wear Rings: Replaceable bronze e. Shaft and Sleeve: Steel shaft with bronze sleeve. <ul style="list-style-type: none"> i. Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing ii. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland f. Mounting: Pump and driver shafts are horizontal, with pump and driver on same base <p>C. Coupling: Flexible and capable of absorbing torsional vibration and shaft misalignment. Include metal coupling guard</p> <p>D. Driver:</p> <ul style="list-style-type: none"> a. Standard: FM approved b. Type: Electric motor; NEMA MG 1, polyphase Design B <p>E. Capacities and Characteristics: (Refer to Equipment Schedule)</p> <p>3) FIRE-PUMP ACCESSORIES AND SPECIALTIES</p> <p>A. Pipe sizes for pump test header, relief valves, discharge cones, and number and size of manifold hose valves are set by NFPA 20, so are not required in this article</p> <p>B. Automatic Air-Release Valves: Comply with NFPA 20 for installation in fire-pump casing</p> <p>C. Circulation Relief Valves: FM approved, brass, spring loaded; for installation in pump discharge piping</p> <p>D. Relief Valves:</p> <ul style="list-style-type: none"> a. Description: FM approved, bronze or cast iron, spring loaded; for installation in fire suppression water-supply piping <p>E. Inlet Fitting: Eccentric tapered reducer at pump suction inlet</p> <p>F. Outlet Fitting: Concentric tapered reducer at pump discharge outlet.</p> <p>G. Discharge Cone: Closed type</p> <p>H. Hose Valve Manifold Assembly:</p> <ul style="list-style-type: none"> a. Standard: Comply with requirements in NFPA 20 b. Header Pipe: ASTM A 53/A 53M, Schedule 40, galvanized steel with ends threaded according to ASME B1.20.1 or approved equal c. Header Pipe Fittings: ASME B16.4, galvanized cast-iron threaded fittings d. Automatic Drain Valve: FM approved e. Manifold: 		
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- i. Test Connections: Comply with FM approved except provide outlets without clappers instead of inlets
 - ii. Body: Flush type, brass or ductile iron, with number of outlets required by NFPA 20
 - iii. Nipples: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with ends threaded according to ASME B1.20.1.
 - iv. Adapters and Caps with Chain: Brass or bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads
 - v. Escutcheon Plate: Brass or bronze; rectangular
 - vi. Hose Valves: FM approved, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads
 - vii. Exposed Parts Finish: chrome plated
 - viii. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."
- f. Manifold:
- i. Test Connections: Comply with FM approved except provide outlets without clappers instead of inlets
 - ii. Body: Exposed type, brass, with number of outlets required by NFPA 20
 - iii. Escutcheon Plate: Brass or bronze; round
 - iv. Hose Valves: FM approved, bronze, with outlet threaded according to NFPA 1963 and matching local fire-department threads. Include caps and chains
 - v. Exposed Parts Finish: chrome plated
 - vi. Escutcheon Plate Marking: Equivalent to "FIRE PUMP TEST."

4) FLOWMETER SYSTEMS

- A. Description: FM-Approved, fire-pump flow meter system with capability to indicate flow to not less than 175 percent of fire-pump rated capacity
- B. Pressure Rating: 350 psig (2413 kPa)
- C. Sensor: Annubar probe, orifice plate, or venturi unless otherwise indicated. Sensor size shall match pipe, tubing, flow meter, and fittings
- D. Permanently Mounted Flowmeter: Compatible with flow sensor; with dial not less than 4- 1/2 inches (115 mm) in diameter. Include bracket or device for wall mounting
 - a. Tubing Package: NPS 1/8 or NPS 1/4 (DN 6 or DN 10) soft copper tubing with copper or brass fittings and valves
- E. Portable Flowmeter: Compatible with flow sensor; with dial not less than 4-1/2 inches (115 mm) in diameter and with two 12-foot- (3.7-m-) long hoses in carrying case

5) SOURCE QUALITY CONTROL

			<p>A. Testing: Test and inspect fire pumps according to FM approved requirements for "Operation Test" and "Manufacturing and Production Tests."</p> <p>a. Verification of Performance: Rate fire pumps according to FM approved</p> <p>B. Fire pumps will be considered defective if they do not pass tests and inspections</p> <p>C. Prepare test and inspection reports</p> <p>Warranty: 1 year against factory defect</p>		
3	1	Unit	<p>26GPM JOCKEY PUMP</p> <p>A. Flow Rate = 26 gallons per minute</p> <p>B. Total Dynamic Head = 312 FT.</p> <p>C. BHP = 5 Horsepower</p> <p>D. Voltage = 400 V</p> <p>E. Phase = 3 P</p> <p>F. Hertz = 60 Hz.</p> <p>G. With complete controller & accessories</p> <p>H. The brand must have at least 5 years of existence in the market</p> <p>1) VERTICAL IN-LINE, PRESSURE-MAINTENANCE PUMPS (BY OTHERS)</p> <p>A. Description: Factory-assembled and -tested, vertical, multistage, open-line-shaft turbine pump as defined in HI 2.1-2.2 and HI 2.3; with pump motor mounted above pump head</p> <p>B. Pump Construction:</p> <p>a. Pump Head: Cast iron, for surface discharge, with flange except connections may be threaded in sizes in which flanges are not available</p> <p>b. Pump Head Seal: Stuffing box and stuffing</p> <p>c. Line Shaft: Stainless steel or steel, with corrosion-resistant shaft sleeves</p> <p>d. Line Shaft Bearings: Rubber sleeve, water lubricated</p> <p>e. Line Shaft: Steel</p> <p>f. Line Shaft Bearings: Corrosion resistant, oil lubricated</p> <p>g. Impeller Shaft: Monel metal or stainless steel</p> <p>h. Bowl Section: Multiple cast-iron bowls with closed-type bronze or stainless-steel impellers</p> <p>i. Column Pipe: ASTM A 53/A 53M, Schedule 40, galvanized-steel pipe with threaded ends and cast-iron or steel fittings, in sections 10 feet (3 m) or less, with strainer of cast or fabricated bronze or stainless steel at bottom</p> <p>C. Motor: Single speed with permanently lubricated ball bearings. Comply with requirements in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."</p> <p>a. Power Cord: Factory-connected to motor for field connection to controller and at least 10 feet (3 m) long</p>	1	

			<p>D. Base: Cast iron or steel with hole for electrical cable</p> <p>E. Nameplate: Permanently attached to pump and indicating capacity and characteristics</p> <p>F. Capacities and Characteristics: Refer to Equipment Schedule</p> <p>2) MOTORS</p> <p>A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 15 Section "Common Motor Requirements for Fire Suppression Equipment."</p> <p>a. Motor Sizes: Minimum size as indicated; if not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0</p> <p>b. Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 16 Sections</p> <p>Warranty: 1 year against factory defect</p>		
4	1	Set	<p>Multi-Sport Gym - Constant Pressure System Booster Pump (Triplex with Individual VFD)</p> <p>A. Vertical In-Line Multistage Pump</p> <p>B. Flow Rate = 100 gallons per minute</p> <p>C. Total Dynamic Head = 170 FT.</p> <p>D. BHP = 7.5 Horsepower</p> <p>E. Voltage = 400 V</p> <p>F. Phase = 3</p> <p>G. Hertz = 60 Hz.</p> <p>H. With complete controller & accessories</p> <p>1) WATER PUMPS</p> <p>A. General:</p> <p>a. Pumps shall be so selected that the operating duty point is within 5% of the maximum efficiency point. The pump casing so selected shall have ample space to take an impeller one size larger than that capable of performing the operating duty</p> <p>b. The pump shall have a speed of not more than 1500 rpm unless otherwise approved by the MEEPF CONSULTANT. All pumps and motors shall be of minimum vibration and noise level during operation. Vibration isolators shall be provided for all pump sets</p> <p>c. Facilities shall be provided to prevent starting of pumps when the water tank is at low water level. An indicator for this low water level alarm shall be provided and interfaced with the electronics system</p> <p>d. Facilities to select which pump to be duty pump and standby pump automatically shall be provided and be interchangeable</p> <p>e. Leakage from pump gland shall be drained to the nearest floor waste</p>	1	

- f. Pump curves for all pumps offered shall be submitted. All curve indicating excessive shutoff head will not be approved
- g. Each pump shall be provided with a gate valve at suction and discharge, approved check valve at discharge, approved strainer at suction, flexible connections at pump suction and discharge, eccentric reducer at suction, concentric reducer at discharge, pressure gauges at suction and discharge, circulation relief valve and automatic air relief valve
- h. Appropriate vibration isolation mountings shall be provided for each pump sets
- i. Supply and install a control panel on 16 swg drip proof metal cubicle enclosing the control switchgear and other electrical and control components for each pumping installation. All sensors shall be connected to a separate extra-low voltage termination compartment within the control panel
- j. Power supply to all sensors and external devices associated to the control and monitoring of the pumps and tanks shall be taken from the pump control panel.

B. Pumps:

- a. Pumps shall be of capacities as shown on the drawings
- b. Pumps shall be horizontal end suction, single inlet centrifugal pumps with variable speed control. Pumps shall be complete with mechanical seals with its faces of tungsten carbide against tungsten carbide. The pump shaft shall be of 316 stainless steel, spline type, while the impellers, intermediate chambers and outer sleeve shall be of 304 stainless steel or bronze. The cast iron parts in contact with water shall be electro-coated with primer so as to prevent the formation of rust.
- c. Each pump shall be checked and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for owner / client reference
- d. Pressure Rating: Refer to Section 15140 "Domestic Water Pipng"

C. Floatless Type Level Switch in Water Tanks:

- a. Supply and install floatless type switch probes in the water tanks as indicated below and shown on the drawings.
 - i. Main RC Water Tanks at Underground Level
 - 1. High level alarm (over-flow);
 - 2. Low level alarm;
 - 3. Low level cut-out of booster pumps;
 - 4. Earthing probe
- b. Each probe shall be of the correct length for the particular application and tank location. Electrodes shall be of polished stainless steel 20 mm OD.

Electrode holders shall be weatherproof in all respect.

- c. The earthing probes shall be connected and wired to the building earth systems of the building.
 - d. Each set of electrodes shall be installed inside a 230 mm diameter PVC pipe acting as a wave barrier.
 - e. The level switch set shall operate with a stepped down voltage at 24V maximum. Stepped down transformers shall be provided for each set of control probes and shall be installed inside centralised control cubicles inside pump room.
 - f. Mechanical steel stuffing boxes shall be used.
- D. Control of Duty / Standby Pumps:
- a. Operation of the duty and standby pumps shall be carried out by the following method:
 - i. Automatically by means of pressure sensor (i.e. pressure switches);
 - ii. Manually by means of a local start/stop push buttons on pump local motor control panel and emergency stop switch.
 - iii. The pressure switch shall be installed next to the manual release valve. When the pressure drops to the pre-determined level, a signal will be sent to the pump local motor control panel to start the pump.
 - iv. Automatic controls shall be operated by electronic, floatless type level switches.
- E. Pump Indicator:
- a. The following audible and visible indication shall be provided at the pump local control panels as applicable:
 - i. Red "overflow level" indicator with buzzer for the associated water tanks;
 - ii. Amber "extra high water level" indicator for the associated water tank;
 - iii. Amber "high water level" indicator;
 - iv. Amber "low water level" indicator;
 - v. Red "pump trip" indicator for each pump;
 - vi. Green "pump on" indicator for each pump;
 - vii. "Pump electrical supply healthy" indicator for each pump;
 - viii. Amber "remote/local" status indicator.

2) DOMESTIC BOOSTER PUMP SETS (VARIABLE SPEED DRIVE)

- A. The fully automatic domestic water booster set with variable speed controller shall be of robust design, supplied ready for connection. Booster pumps and pressure tanks shall be mounted on a vibration absorbing mild steel baseplate. Each set shall comprise of the following:
- a. Triplex type approved pattern vertical multi stage pumps.
 - b. One (1) set pressure tank with rubber bag
 - c. One set factory assembled pre-wired fully automatic control cubicle (variable speed controller) in

			<p>weather-proof mild steel enamel finished steel enclosure</p> <p>d. Associate pipework including control valves, water hammer absorbers, check valves, flexible connectors, pressure regulating valves, located in the common pump delivery pipe etc.</p> <p>e. Vibration-absorbing baseplate</p> <p>f. Pressure gauges, pressure switches, and safety valves, etc.</p> <p>g. Thermal relay, indicator lamp, fuse magnetic controller auxiliary relay, alternative relay, terminal board</p> <p>h. 70% pump efficiency.</p> <p>B. Only one pump is in operation at a time, the other one on standby. The pumps are changed over after each cycle by an automatic device. But the second pump will be automatically switched on when the water pressure drops down to the minimum set pressure and then the two pumps are in parallel operation with one in variable speed and the other at full load. Dry running protection should also be provided</p> <p>C. Pressure tank shall be of stainless steel cylindrical pre-changed pressure vessel with epoxy or polypropylene anti-corrosion lining in the internal surface. A rubber bag shall be fitted for separation of the water nitrogen gas. Externally treated in synthetic enamel. An approved type valve shall be fitted for pre-pressure adjustment. Baseplate is manufactured in heavy gauge fabricated mild steel, zinc plate finish</p> <p>D. All pipings, flexible connectors, gate valve and non-return valves shall be as described in the Pipework, Fitting and Valve Section</p> <p>E. The following accessories shall be provided;</p> <p>a. One (1) no. pressure gauge with syphon pipes and isolating valves in the pressure tank air chamber.</p> <p>b. Three (3) nos. adjustable pressure switches for incoming and outgoing pressure adjustable individually and low water pressure (no flow) cut-out of booster pumps</p> <p>c. One (1) no. bronze drain cock at the bottom of the pressure tank</p> <p>d. One (1) no. 25mm diaphragm type safety valve at the air chamber of pressure tank.</p> <p>A test certificate for the performance and test pressure of the tank issued by the manufacturer must be submitted</p> <p>Warranty: 1 year against factory defect</p>		
5	1	Set	<p>ACADEMIC/ADMIN BUILDING - CONSTANT PRESSURE SYSTEM BOOSTER PUMP (TRIPLEX WITH INDIVIDUAL VFD)</p> <p>A. Vertical In-line Multi-Stage Pump</p> <p>B. Flow Rate = 100 gallons per minute</p> <p>C. Total Dynamic Head = 150 FT.</p> <p>D. BHP = 7.5 Horsepower</p>		

- E. Voltage = 400 V
 - F. Phase = 3
 - G. Hertz = 60 Hz.
 - H. The brand must have at least 5 years of existence in the market
 - I. With complete controller & accessories
- 1) WATER PUMPS
- A. General:
- a. Pumps shall be so selected that the operating duty point is within 5% of the maximum efficiency point. The pump casing so selected shall have ample space to take an impeller one size larger than that capable of performing the operating duty
 - b. The pump shall have a speed of not more than 1500 rpm unless otherwise approved by the MEEPF CONSULTANT. All pumps and motors shall be of minimum vibration and noise level during operation. Vibration isolators shall be provided for all pump sets
 - c. Facilities shall be provided to prevent starting of pumps when the water tank is at low water level. An indicator for this low water level alarm shall be provided and interfaced with the electronics system
 - d. Facilities to select which pump to be duty pump and standby pump automatically shall be provided and be interchangeable
 - e. Leakage from pump gland shall be drained to the nearest floor waste
 - f. Pump curves for all pumps offered shall be submitted. All curve indicating excessive shutoff head will not be approved
 - g. Each pump shall be provided with a gate valve at suction and discharge, approved check valve at discharge, approved strainer at suction, flexible connections at pump suction and discharge, eccentric reducer at suction, concentric reducer at discharge, pressure gauges at suction and discharge, circulation relief valve and automatic air relief valve
 - h. Appropriate vibration isolation mountings shall be provided for each pump sets
 - i. Supply and install a control panel on 16 swg drip proof metal cubicle enclosing the control switchgear and other electrical and control components for each pumping installation. All sensors shall be connected to a separate extra-low voltage termination compartment within the control panel
 - j. Power supply to all sensors and external devices associated to the control and monitoring of the pumps and tanks shall be taken from the pump control panel.
- B. Pumps:
- a. Pumps shall be of capacities as shown on the drawings

- b. Pumps shall be horizontal end suction, single inlet centrifugal pumps with variable speed control. Pumps shall be complete with mechanical seals with its faces of tungsten carbide against tungsten carbide. The pump shaft shall be of 316 stainless steel, spline type, while the impellers, intermediate chambers and outer sleeve shall be of 304 stainless steel or bronze. The cast iron parts in contact with water shall be electro-coated with primer so as to prevent the formation of rust
 - c. Each pump shall be checked and regulated for proper differential pressure, voltage and amperage draw. This data shall be noted on a permanent tag or label and fastened to the pump for owner / client reference
 - d. Pressure Rating: Refer to Section 15140 "Domestic Water Piping"
- C. Floatless Type Level Switch in Water Tanks:
- a. Supply and install float less type switch probes in the water tanks as indicated below and shown on the drawings
 - i. Main RC Water Tanks at Underground Level
 - 1. High level alarm (over-flow);
 - 2. Low level alarm;
 - 3. Low level cut-out of booster pumps;
 - 4. Earthing probe
 - b. Each probe shall be of the correct length for the particular application and tank location. Electrodes shall be of polished stainless steel 20 mm OD. Electrode holders shall be weatherproof in all respect.
 - c. The earthing probes shall be connected and wired to the building earth systems of the building
 - d. Each set of electrodes shall be installed inside a 230 mm diameter PVC pipe acting as a wave barrier
 - e. The level switch set shall operate with a stepped down voltage at 24V maximum. Stepped down transformers shall be provided for each set of control probes and shall be installed inside centralised control cubicles inside pump room
 - f. Mechanical steel stuffing boxes shall be used
- D. Control of Duty / Standby Pumps:
- a. Operation of the duty and standby pumps shall be carried out by the following method:
 - i. Automatically by means of pressure sensor (i.e. pressure switches);
 - ii. Manually by means of a local start/stop push buttons on pump local motor control panel and emergency stop switch
 - iii. The pressure switch shall be installed next to the manual release valve. When the pressure drops to the pre-determined level, a signal will be sent to the pump local motor control panel to start the pump

iv. Automatic controls shall be operated by electronic, floatless type level switches.

E. Pump Indicator:

- a. The following audible and visible indication shall be provided at the pump local control panels as applicable:
 - i. Red "overflow level" indicator with buzzer for the associated water tanks;
 - ii. Amber "extra high water level" indicator for the associated water tank;
 - iii. Amber "high water level" indicator;
 - iv. Amber "low water level" indicator;
 - v. Red "pump trip" indicator for each pump;
 - vi. Green "pump on" indicator for each pump;
 - vii. "Pump electrical supply healthy" indicator for each pump;
 - viii. Amber "remote/local" status indicator

2) DOMESTIC BOOSTER PUMP SETS (VARIABLE SPEED DRIVE)

A. The fully automatic domestic water booster set with variable speed controller shall be of robust design, supplied ready for connection. Booster pumps and pressure tanks shall be mounted on a vibration absorbing mild steel baseplate. Each set shall comprise of the following:

- a. Triplex type approved pattern vertical multi stage pumps
- b. One (1) set pressure tank with rubber bag
- c. One set factory assembled pre-wired fully automatic control cubicle (variable speed controller) in weather-proof mild steel enamel finished steel enclosure
- d. Associate pipework including control valves, water hammer absorbers, check valves, flexible connectors, pressure regulating valves, located in the common pump delivery pipe etc
- e. Vibration-absorbing baseplate
- f. Pressure gauges, pressure switches, and safety valves, etc.
- g. Thermal relay, indicator lamp, fuse magnetic controller auxiliary relay, alternative relay, terminal board
- h. 70% pump efficiency.

B. Only one pump is in operation at a time, the other one on standby. The pumps are changed over after each cycle by an automatic device. But the second pump will be automatically switched on when the water pressure drops down to the minimum set pressure and then the two pumps are in parallel operation with one in variable speed and the other at full load. Dry running protection should also be provided.

C. Pressure tank shall be of stainless steel cylindrical pre-changed pressure vessel with epoxy or polypropylene anti-corrosion lining in the internal surface. A rubber bag shall be fitted for separation of the water nitrogen gas. Externally treated in synthetic enamel. An approved type valve shall

			<p>be fitted for pre-pressure adjustment. Baseplate is manufactured in heavy gauge fabricated mild steel, zinc plate finish.</p> <p>D. All pipings, flexible connectors, gate valve and non-return valves shall be as described in the Pipework, Fitting and Valve Section.</p> <p>a. The following accessories shall be provided;</p> <ol style="list-style-type: none"> i. One (1) no. pressure gauge with syphon pipes and isolating valves in the pressure tank air chamber ii. Three (3) nos. adjustable pressure switches for incoming and outgoing pressure adjustable individually and low water pressure (no flow) cut-out of booster pumps iii. One (1) no. bronze drain cock at the bottom of the pressure tank iv. One (1) no. 25mm diaphragm type safety valve at the air chamber of pressure tank. <p>A test certificate for the performance and test pressure of the tank issued by the manufacturer must be submitted</p> <p>Warranty: 1 year against factory defect</p>		
6	1	Set	<p>LANDSCAPE - CONSTANT PRESSURE SYSTEM BOOSTER PUMP</p> <p>A. Vertical In-Line Multistage Pump B. Flow Rate = 75 gallons per minute C. Total Dynamic Head = 260 FT. D. BHP = 10 Horsepower E. Voltage = 400 V F. Phase = 3 G. Hertz = 60 Hz. H. The brand must have at least 5 years of existence in the market. I. With complete controller & accessories</p> <p>1) LEVEL PROBES IN TANKS</p> <p>A. The Sub-Contractor shall supply and install level probes in water tanks as indicated below and shown on the Drawings</p> <ol style="list-style-type: none"> a. Underground water tank: <ol style="list-style-type: none"> i. High level alarm (overflow) ii. Low level alarm iii. Low water level cut-out for the transfer water pumps iv. Earthing probe v. Additional probe (refer to Schematic Diagram) b. Each probe shall be of the correct length for its particular application and tank location. Electrodes shall be of polished stainless steel 20mm O.D. Electrode holders shall be weather-proof in all respect c. The earthing probes shall be connected and wired to the building earth systems of the building 		

- d. Each set of electrodes shall be installed inside a Ø 250 diameter PVC pipe acting as a wave barrier
- e. The level switch set shall operate with a stepped down voltage at 24V maximum. Stepped down transformers shall be provided of control probes and shall be installed inside control cubicles.

2) ANTI-VORTEX PLATES

- A. Anti-vortex plates shall be installed at the end of the pump suction tanks as shown on Drawings.

3) ANTI-VIBRATION MOUNTINGS

- A. Anti-vibration mountings shall be inertia base, springs, neoprene pads or rubber-inshear isolators, with the specified static deflection and selected to provide isolating efficiency of not less than 95%.

4) TANK FITTINGS

- A. Outlet, inlet, overflow and rain pipes connected to reinforced cement concrete water tanks shall be:
 - a. Screwed joint tank ferrules for the use in nominal pipe sizes up to 50mm and flanged joint for use in nominal pipe sizes over 50mm.
- B. Overflow pipes shall be:
 - a. With minimum internal diameter larger than the internal diameter of inlet pipes.
 - b. Dipped down inside tanks so as to terminate in a position maximum 150mm above bottom of tanks.
 - c. Provided with metal hinged flaps at outlets, and wire mesh screen, to prevent vermin and insects entering.
 - d. Discharging in conspicuous position.
- C. Float valves or flow switches shall shut off the supply when the water level is 10 cm below the invert level of overflow pipes.
- D. Invert level of inlet pipes shall be minimum 10 cm above the top overflow pipes.
- E. Vent pipes at the top of tanks shall be bent to the required shape and be fitted with wire mesh screen to prevent vermin and insects entering.
- F. Unless otherwise specified, all overflows, vents, silencing pipe and drain pipes shall be galvanized steel pipes medium grade and pipe fittings shall be the same as described in "Pipework" Section.

5) FLEXIBLE PUMP CONNECTORS

- A. Flexible connections at inlets and outlets of pumps shall be of twin sphere neoprene rubber impregnated fabric reinforcement, below shape with flanged ends. The flexible connectors shall be designed for excellent vibration and noise protection. Isolated tension members shall be provided to prevent excessive elongation. Flexible connections shall be suitable for the specified working fluid and specified working pressure and temperature.

6) STRAINERS

- A. Provide Spirax Limited pipeline strainers with stainless steel screens according to the following:

			<ul style="list-style-type: none"> a. Pipe Schedule: b. Steel: Up to 50mm, Type Y, IT Cast Iron Model and 0.76mm 20 mesh c. Steel: 65mm to 150mm, Type Y, IF Standard for Water Model and 3mm <ul style="list-style-type: none"> B. Supply one extra set of strainer screens and install after systems have been thoroughly cleaned. C. Equip each strainer 40 mm and smaller in size, with plugged blow off tappings. D. Equip each strainer 50 mm and larger in size, with blow off tapping. Provide blow off piping complete with capped shut off valve. Terminate in downward vertical position. Size blow off piping and valve the same size as the blow off tapping. E. Ensure that each strainer can be isolated from piping systems with isolating valves on each side of strainer, and which are not more than 3 metres away from strainer. F. Provide strainers in the following locations: <ul style="list-style-type: none"> a. At the suction side of each domestic water pump b. Immediately upstream of each pressure reducing valve c. Where shown on Detail Drawings <p>7) RECIRCULATING PUMP</p> <ul style="list-style-type: none"> A. Max. Working Pressure: 125 psi B. RPM: 3250 C. Stainless Steel Cartridge D. Ceramic Shaft E. IFC Model with integrated check valve <p>Warranty: 1 year against factory defect</p>		
7	1	Set	<p>SUMP PUMP - 250GPM DUPLEX, NON-CLOG SUBMERSIBLE, QUICK DISCONNECT PUMP</p> <ul style="list-style-type: none"> A. Non-clog Submersible, Quick Disconnect Pump B. Flow Rate = 250 gallons per minute C. Total Dynamic Head = 70 FT. D. BHP = 15 Horsepower E. Voltage = 400 V F. Phase = 3 G. Hertz = 60 Hz. H. With complete controller & accessories <p>1) SUBMERSIBLE SUMP PUMPS</p> <ul style="list-style-type: none"> A. Submersible, Quick-Disconnect, Double-Seal Sump Pumps: <ul style="list-style-type: none"> a. Description: Factory-assembled and -tested sump-pump unit with guide-rail supports. b. Pump type: Submersible, end-suction, single-stage, close-coupled, overhung impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3. c. Pump Casing: Cast iron, with open inlet, and discharge fittings for connection to guide-rail support. 		

- d. Impeller: Statically and dynamically balanced, stainless steel, nonclog, open, or semi open design for solids handling, and keyed and secured to shaft.
- e. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.
- f. Seals: Mechanical.
- g. Moisture-Sensing Probe: Internal moisture sensor and moisture alarm.
- h. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump
- i. Motor Housing Fluid: Oil
- j. Controls:
 - i. Enclosure: NEMA 3R
 - ii. Switch Type: Pedestal-mounted float switch with float rods and rod buttons
 - iii. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load
 - iv. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches (1500 mm)
 - v. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- k. Controls:
 - i. Enclosure: NEMA 250, wall-mounted
 - ii. Switch Type: Mechanical-float type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables
 - iii. Automatic Alternator: Start pumps on successive cycles and start multiple pumps if one cannot handle load
 - iv. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.
- l. Control-Interface Features:
 - i. Remote Alarm Contacts: For remote alarm interface
 - ii. Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:
 - 1. On-off status of pump
 - 2. Alarm status
- m. Guide-Rail Supports:
 - i. Standard: SWPA's "Submersible Sump Pumping Systems (SWPA) Handbook."
 - ii. Guide Rails: Vertical pipes or structural members, made of galvanized steel or other corrosion-resistant metal, attached to baseplate and basin sidewall or cover

			<ul style="list-style-type: none"> iii. Baseplate: Corrosion-resistant metal plate, attached to basin floor, supporting guide rails and stationary elbow iv. Pump Yoke: Motor-mounted or casing-mounted yokes or other attachments for aligning pump during connection of flanges v. Movable Elbow: Pump discharge-elbow fitting with flange, seal, and positioning device vi. Stationary Elbow: Fixed discharge-elbow fitting with flange that mates to movable-elbow flange and support attached to baseplate vii. Lifting Cable: Stainless steel; attached to pump and cover at manhole <p>Warranty: 1 year against factory defect</p>		
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Bidder's Authorized Representative:

Signature over Printed Name

Principal Bidder / Supplier