

DRAFT OF THE EXPANDED ASEAN SANITARY ENGINEERING INFORMATION EXCHANGE FRAMEWORK OUTLINE

Sanitary engineering in the Philippines, rooted from civil engineering, was created by Republic Act No. 1364, on June 18, 1955. The law focuses on public health and environmental engineering, outlining the qualifications required to be a registered sanitary engineer, and establishes guidelines for the practice to ensure the protection of public health through sanitation and pollution control engineering

Section 1: Education

1. EDUCATIONAL INSTITUTIONS:

- A. List of recognized universities and colleges offering sanitary engineering programs;
 - 1) List of universities and colleges recognized by the Commission on Higher Education (CHED) offering a Bachelor of Science in Sanitary/ Environmental and Sanitary Engineering;
 - a) De La Salle University- Dasmaringas Cavite
 - b) National University (NU)- Manila
 - c) Mapúa University- Manila
 - d) Technological Institute of the Philippines (TIP-QC)- Quezon City
 - e) Manuel L. Quezon University- Quezon City
 - f) Saint Louis University (SLU)- San Fernando, La Union
 - g) Saint Paul University Philippines- Tuguegarao City, Cagayan
 - h) University of Baguio (UB)- Baguio City
 - i) University of the Cordilleras- Baguio City
 - 2) List of State universities created by legislation following the Commission on Higher Education (CHED) program in Bachelor of Science in Sanitary;
 - a) Partido State University- Goa, Camarines Sur
 - Republic Act No. 9029, March 5, 2001, created the Partido State University.
 - b) Batangas State University- Batangas City
 - On 22 March 2001, Pablo Borbon Memorial Institute of Technology was converted into Batangas State University under Republic Act No. 9045
 - c) University of Southeastern Philippines (State U)- Davao City
 - The University of Southeastern Philippines, the only state university in Region XI, was created on December 15, 1978, through the passage of Batas Pambansa Bilang 12. Batas Pambansa Bilang 12 promulgated the integration of four state institutions to develop the University of Southeastern Philippines (USEP)
 - d) Western Mindanao State University- Zamboanga City, Zamboanga del Sur

- The Mindanao State University was created under Republic Act 1387; the university was formally organized on September 1, 1961.

B. Accreditation Authorities and Criteria

- 1) Professional Regulatory Board of Sanitary Engineering
 - a) Accreditation of Learning institutions based on R.A. 1364 (ANNEX-1, Sanitary Engineering law) and CHED requirements
 - b) Professional Board Evaluation on the Accreditation of PSSEI based on the Security and Exchange Commission requirements
- 2) Professional Regulation Commission
 - a) Accreditation of the Professional Organization- PSSEI
 - b) CPD Council -for evaluation and allocation of credit units
 - c) CPSP-CATS Council- for CPD units equivalencies, evaluation, and credit transfer in specialization units
- 3) Commission of Higher Education
 - a) Accreditation of learning institutions based on PSG CMO 98 s 17
 - i. Philippine Association of Colleges and Universities Commission of Accreditation (PACUCOA)
 - ii. Accreditation Board for Engineering and Technology (ABET)

2. CURRICULUM OVERVIEW:

The Minimum Curriculum is lifted from PSG CMO 98 s 2017

A. Core subjects and electives for Bachelor of Science in Sanitary Engineering.

Section 11 Minimum Curriculum

11.1. Components:

Below is the minimum curriculum of the BSSE program. The institution may enrich the sample curriculum depending on the needs of the industry and community, provided that all prescribed courses are offered and pre-requisite and co-requisite are observed.



Classification/ Field/ Course	No. of Hours		Units
	Lecture	Laboratory	
I. TECHNICAL COURSES			
A. MATHEMATICS			
Calculus 1 (Differential Calculus)	3	0	3
Calculus 2 (Integral Calculus)	3	0	3
Differential Equations	3	0	3
Engineering Data Analysis	3	0	3
Numerical Solutions to Engineering Problems	2	3	3
Sub-total	14	3	15
B. NATURAL AND PHYSICAL SCIENCES			
Chemistry for Engineers	3	3	4
Physics for Engineers (Calculus-based)	3	3	4
Geology	2	0	2
Sub-total	8	6	10
C. BASIC ENGINEERING SCIENCES			
Sanitary Engineering Orientation	1	0	1
Engineering Drawing and Plans	0	3	1
Computer Fundamentals and Programming	0	6	2
Computer-Aided Drafting	0	3	1
Statics of Rigid Bodies	3	0	3
Dynamics of Rigid Bodies	2	0	2
Mechanics of Deformable Bodies	4	0	4
Engineering Economics	3	0	3
Engineering Management	2	0	2
Technopreneurship 101	3	0	3
Sub-total	18	12	22
D. ALLIED COURSES			
Basic Mechanical Engineering	3	0	3
Basic Electrical Engineering	3	0	3
Environmental Science and Engineering	3	0	3
Sub-total	9	0	9
E. PROFESSIONAL COURSES			
Fundamentals of Surveying	3	6	5



Classification/ Field/ Course	No. of Hours		Units
	Lecture	Laboratory	
Construction Materials and Testing	2	3	3
Structural Theory	3	3	4
Principles of Reinforced/Prestressed Concrete	3	3	4
Hydraulics	4	3	5
Hydrology	3	0	3
Sanitary Engineering Laws, Contracts and Ethics	3	0	3
Geotechnical Engineering (Soil Mechanics)	3	3	4
Project Management	3	3	4
Environmental and Sanitary Chemistry	2	3	3
Microbiology and Parasitology for Env. Engineers	2	3	3
Public Health Engineering	2	0	2
Occupational Health and Safety	2	0	2
Solid and Hazardous Waste Engineering	3	0	3
Environmental Planning, Laws and Impact Assessment	3	0	3
Water Supply Planning and Development	3	0	3
Sewerage and Urban Drainage	3	0	3
Sanitary Science, Fire Protection and Plumbing as Applied to Buildings	2	3	3
Environmental Engineering Laboratory	0	3	1
Water Purification Process Design	3	0	3
Sewage and Industrial Wastewater Treatment	3	0	3
SE Project 1	1	3	2
SE Project 2	0	3	1
Sub-total	56	42	70
F. ON-THE-JOB-TRAINING			
Sanitary Engineering OJT/Practicum (240 hours)	2	3	3
Sub-total	2	3	3
TOTAL TECHNICAL COURSES	107	66	129



Classification/ Field/ Course	No. of Hours		Units
	Lecture	Laboratory	
II. NON-TECHNICAL COURSES			
A. GENERAL EDUCATION COURSES			
Science, Technology and Society	3	0	3
Readings in Philippine History	3	0	3
Mathematics in the Modern World	3	0	3
Contemporary World	3	0	3
Understanding the Self	3	0	3
Purposive Communication	3	0	3
Art Appreciation	3	0	3
Ethics	3	0	3
Suib-total	24	0	24
B. GEC ELECTIVE/MANDATED COURSES			
GE Elective 1	3	0	3
GE Elective 2	3	0	3
GE Elective 3	3	0	3
Life and Works of Rizal	3	0	3
Sub-total	12	0	12
C. PHYSICAL EDUCATION			
Physical Education 1, 2, 3 and 4	8	0	8
Sub-total	8	0	8
D. NSTP			
NSTP 1, and 2	6	0	6
Sub-total	6	0	6
TOTAL NON-TECHNICAL COURSES	50	0	50
GRAND TOTAL	157	66	179

GRAND TOTAL = 179 units

SUMMARY OF THE BSSE CURRICULUM

Classification/Field	Total No. of Hours		Total No. of Units
	Lecture	Laboratory	
I. TECHNICAL COURSES			
A. Mathematics	14	3	15
B. Natural and Physical Sciences	8	6	10
C. Basic Engineering Sciences	18	12	22
D. Allied Courses	9	0	9
E. Professional Courses	56	42	70
F. On-the-job Training	2	3	3
Sub- Total	107	66	129
II. GENERAL EDUCATION/ ELECTIVES/MANDATED COURSES			
A. General Education Courses	24	0	24
B. General Electives/Mandated Courses	12	0	12
C. PE/NSTP	14	0	14
Sub-Total	50	0	50
Grand TOTAL	157	66	179

B. Baccalaureate program duration and structure

SAMPLE SEMESTRAL PROGRAM OF STUDY

FIRST YEAR*1st Year – First Semester*

Subjects	No. of Hours		Units	Prerequisite/Co-requisite
	Lec	Lab		
GE Elective 1	3	0	3	None
Sanitary Engineering Orientation	1	0	1	None
Engineering Drawings and Plans	0	3	1	None
Calculus 1 (Differential Calculus)	3	0	3	None
Chemistry for Engineers	3	3	4	None
Science, Technology and Society	3	0	3	None
Mathematics in the Modern World	3	0	3	None
Contemporary World	3	0	3	None
PE 1			2	None
Total	19	6	23	

1st Year – Second Semester

Subjects	No. of Hours		Units	Prerequisite/Co-requisite
	Lec	Lab		
Calculus 2 (Integral Calculus)	3	0	3	Calculus 1
Environmental and Sanitary Chemistry	2	3	3	Chemistry for Engineers
Engineering Data Analysis	3	0	3	None
Physics for Engineers (Calculus-based)	3	3	4	Calculus 1
Geology	2	0	2	Chemistry for Engineers
Computer Fundamentals and Programming	0	6	2	None
GE Elective 2	3	0	3	None
PE 2			2	PE 1
Total	16	12	22	

SECOND YEAR**2nd Year – First Semester**

Subjects	No. of Hours		Units	Prerequisite/Co-requisite
	Lec	Lab		
GE Elective 3	3	0	3	None
Readings in Philippine History	3	0	3	None
Differential Equations	3	0	3	Calculus 2
Statics of Rigid Bodies	3	0	3	Physics 1, Calculus 2
Fundamentals of Surveying	3	6	5	Engineering Orientation
Life and Works of Rizal	3	0	3	None
PE 3			2	PE 2
NSTP 1			3	2nd year standing
Total	15	9	25	

2nd Year – Second Semester

Subjects	No. of Hours		Units	Prerequisite/Co-requisite
	Lec	Lab		
Computer-Aided Drafting	0	3	1	Computer Fundamentals and Programming
Engineering Economics	3	0	3	Engineering Orientation
Purposive Communication	3	0	3	None
Art Appreciation	3	0	3	None
Ethics	3	0	3	None
Mechanics of Deformable Bodies	4	0	4	Statics of Rigid Bodies
Dynamics of Rigid Bodies	2	0	2	Statics of Rigid Bodies
PE 4			2	PE 3
NSTP 2			3	NSTP 1
Total	18	0	24	

THIRD YEAR**3rd Year – First Semester**

Subjects	No. of Hours		Units	Prerequisite/Co-requisite
	Lec	Lab		
Numerical Solutions to Engineering Problems	2	3	3	Differential Equations
Construction Materials and Testing	2	3	3	Mechanics of Deformable Bodies, Dynamics of Rigid Bodies
Environmental Science and Engineering	3	0	3	Environmental and Sanitary Chemistry
Basic Mechanical Engineering	3	0	3	Physics for Engineers (Calculus-based)
Microbiology and Parasitology for Environmental Engineers	2	3	3	Environmental and Sanitary Chemistry
Structural Theory	3	3	4	Mechanics of Deformable Bodies
Basic Electrical Engineering	3	0	3	Physics for Engineers (Calculus-based)
Total	18	12	22	

3rd Year – Second Semester

Subjects	No. of Hours		Units	Prerequisite/Co-requisite
	Lec	Lab		
Engineering Management	2	0	2	Engineering Economics
Hydraulics	4	3	5	Basic Mechanical Engineering
Hydrology	3	0	3	Differential Equations
Project Management	3	3	4	Construction Materials and Testing
Principles of Reinforced Concrete	3	3	4	Structural theory
Public Health Engineering	2	0	2	Microbiology and Parasitology for Environmental Engineers, Environmental Science and Engineering
Occupational Health and Safety	2	0	2	Microbiology and Parasitology for Environmental Engineers, Environmental Science and Engineering
Total	19	9	22	

SUMMER OR SPECIAL TERM

Sanitary Engineering OJT/Practicum (240 hours)	2	3	3	Incoming 4th year
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FOURTH YEAR**4th Year – First Semester**

Subjects	No. of Hours		Units	Prerequisite/Co-requisite
	Lec	Lab		
Technopreneurship 101	3	0	3	Engineering Management
Geotechnical Engineering (Soil Mechanics)	3	3	4	Geology, Mechanics of Deformable Bodies, Dynamics of Rigid Bodies
Environmental Planning, Laws and Impact Assessment	3	0	3	Microbiology and Parasitology, Environmental Chemistry, Hydrology
Water Supply Planning and Development	3	0	3	Hydraulics, Hydrology
Sewerage and Urban Drainage	3	0	3	Hydraulics, Hydrology
Sanitary Science, Fire Protection and Plumbing as Applied to Buildings	2	3	3	Hydraulics
SE Project 1	1	3	2	Project Management, Engineering Data Analysis
Total	18	9	21	

4th Year – Second Semester

Subjects	No. of Hours		Units	Prerequisite/ (Co-requisite)
	Lec	Lab		
Sanitary Engineering Laws, Contracts and Ethics	3	0	3	Solid Waste Mgt., Envi. Laws and Impact Assessment
Understanding the Self	3	0	3	None
Environmental Engineering Laboratory	0	3	1	Envi. Laws and Impact Assessment
Planning and Design in Envi. and Sanitary Engineering	1	3	2	Envi. Laws and Impact Assessment
Water Purification Process Design	3	0	3	Water Supply Planning and Development
Sewage and Industrial Wastewater Treatment	3	0	3	Sewerage and Urban Drainage
Solid and Hazardous Waste Engineering	2	0	2	Environmental and Sanitary Chemistry
SE Project 2	0	3	1	SE Project 1
Total	15	9	18	

GRAND TOTAL**179**

C. Course Specifications of Bachelor of Science in Sanitary Engineering under CHED PSG CMO 98 s 2017 (Please See ANNEX 2)

D. Bridging Program from Civil Engineering to Sanitary Engineering

1) Legal Basis:

a) PRB-SE Board Resolution 4 s 2023;

“Complying with R.A.1364(Sanitary Engineering Law), Sec 17, Art III; provides for the qualifications of applicants for the Sanitary Engineers Licensure Examination (SELE), to wit:

- i. at least twenty-one (21) years of age;
- ii. a citizen of the Philippines;
- iii. of good reputation and moral character; and
- iv. a graduate of a four-year course in sanitary engineering or BSCE having taken major subjects in sanitary engineering from a school, institute, college, or university recognized by the Government or the State wherein it is established.”

b) RCE- SE Bridging Program (ANNEX-3);

“For a registered Civil Engineer to qualify for the Sanitary Engineering Licensure Examination under Section 17(d) of R.A. No. 1364, he/she must take MAJOR SUBJECTS IN SANITARY ENGINEERING from a school, institute, college or university recognized by the Government, as prescribed under CHED Memorandum Order No. 98 (s. 2017):

Third-year subjects:

- A. Environmental Science and Engineering
- B. Microbiology and Parasitology for Environmental Engineers
- C. Public Health Engineering
- D. Occupational Health and Safety

Fourth-year subjects:

- a. Environmental Planning, Laws, and Impact Assessment
- b. Water Supply Planning and Development
- c. Sewerage and Urban Drainage
- d. Sanitary Science, Fire Protection, and Plumbing, as applied to Buildings
- e. Sanitary Engineering Laws, Contracts and Ethics
- f. Environmental Engineering Laboratory
- g. Planning and Design in Environmental and Sanitary Engineering
- h. Water Purification Process Design
- i. Sewage and Industrial Wastewater Treatment
- j. Solid and Hazardous Waste Engineering”

E. Master in Sanitary Engineering program duration and structure

- 1) This master's program is intended for Bachelor of Science in Environmental and Sanitary Engineering graduates. The aim is to develop a high-quality graduate education, training, and research capacity in Sanitary and Environmental Engineering. The program emphasizes advanced knowledge in specializations in water and wastewater treatment, environmental health, and engineering sustainability, in both local and global challenges. Programs offered by institutions slightly differ but aim to deepen students' expertise in environmental and sanitary engineering, focusing on public health issues related to water resources and environmental management.

- 2) Key components of the curriculum include:
 - a) Water and Wastewater Treatment: Advanced topics on the design of public health water management, optimization of systems that purify water, and treatment and disposal of wastewater;
 - b) Environmental Health and Sanitation: Courses addressing public health concerns, industrial hygiene, waste disposal, hazards exposure, Sanitation, and environmental protection.
 - c) Hydrology and Water Resources Engineering: Study of water management systems, flood control, and sustainable use of water resources.
 - d) Effects of climate change and mitigation management of calamity hazards
 - e) Solid Waste Management: Focuses on waste minimization, recycling, and sustainable waste management practices.
 - f) Some institutions emphasize exposure and modern practices in sanitary engineering, integrating ethics, social responsibility, and professional skills to prepare students for the evolving demands in the industry.
 - g) Research and Thesis: The curriculum includes real-world issues, theoretical coursework, and practical applications, in sanitation and environmental engineering challenges.
- 3) CHED's policies and guidelines shape these programs to ensure they are globally competitive in environmental and public health engineering.
- 4) Schools presently offering MSSE:
 - a) National University
 - b) Manuel L. Quezon University
- 5) Revised Curriculum (National University)



NATIONAL UNIVERSITY
551 M.F. Jhocson Street, Sampaloc
Manila 1008 Philippines

Course Curriculum: REVISED CURRICULUM MASTER OF SCIENCE IN SANITARY ENGINEERING (MSSE)
Effectivity Year: 2021

FIRST YEAR – FIRST TRIMESTER				
COURSE CODE	COURSE TITLE	UNITS		HOURS
		LEC	LAB	
MSSEB130	Numerical Methods and Optimization	3	0	4:00
MSSEB230	Statistical Design and Analysis	3	0	4:00
MSSEB330	Research Design and Methodology	3	0	4:00
TOTAL		9	0	12:00
FIRST YEAR – SECOND TRIMESTER				
COURSE CODE	COURSE TITLE	UNIT		HOURS
		LEC	LAB	
MSSEM130	Principles of Public Health Engineering	3	0	4:00
MSSEM230	Environmental Management and Control	3	0	4:00
MSSEM330	Advance Sewage and Industrial Wastewater	3	0	4:00
TOTAL		9	0	12:00
FIRST YEAR – THIRD TRIMESTER				
COURSE CODE	COURSE TITLE	UNIT		HOURS
		LEC	LAB	
MSSEM430	Advance Water Supply Planning and Development	3	0	4:00
MSSEM530	Environmental Health and Impact Analysis	3	0	4:00
TOTAL		6	0	8:00
SECOND YEAR – FIRST TRIMESTER				
COURSE CODE	COURSE TITLE	UNITS		HOURS
		LEC	LAB	
MSSEB130	Advanced Hydraulics & Engineering Hydrology	3	0	4:00
	Comprehensive Exam			
TOTAL		3	0	4:00
SECOND YEAR – SECOND TRIMESTER				
COURSE CODE	COURSE TITLE	UNITS		HOURS
		LEC	LAB	
GTHES130	Graduate Thesis 1	3	0	4:00
TOTAL		3	0	4:00
SECOND YEAR – THIRD TRIMESTER				
COURSE CODE	COURSE TITLE	UNIT		HOURS
		LEC	LAB	
GTHES230	Graduate Thesis 2	3	0	4:00
TOTAL		3	0	4:00
TOTAL NO. OF UNITS		NATIONAL-U		NATIONAL-U TOTAL ADDITIONAL
		LEC	LAB	
		33	0	
		CHED		
		TOTAL		
		30		3

- 6) Course Specifications of Master of Science in Sanitary Engineering under
(Please See ANNEX 2A and AB)

F. Doctor in Sanitary Engineering program duration and structure

- 1) Doctor of Science in Sanitary Engineering in the Philippines typically builds upon the core principles related to programs, such as environmental engineering, public health, and water resource management. The post-graduate Doctor in Sanitary Engineering in Environmental Engineering can be taken in Institutions granted Centers of Excellence or in universities in advanced countries.
- 2) In response to the increasing complexity of health programs and national concern for human settlements and communities, the scope of public health has evolved from preventive medicine to a multi-faceted discipline that embraces the biological, physical, and social sciences. Locally, only the University of the Philippines offers a specialty in Public Health.

- 3) The continued growth of public health requires the training of individuals who will assume leadership roles in the field of public health. The Doctor of Public Health (DrPH) program is designed to meet this need. It is primarily oriented to prepare professionals who will occupy key positions in teaching, research, and administration in the health sciences. Specifically, at the end of the program, the DrPH graduates should be able to:
- a) Apply scientific theories and methods of inquiry to assess public health problems in the context of social, environmental, and ethical considerations;
 - b) Generate new knowledge to address public health problems through the conduct of relevant and ethical research projects
 - c) Take the lead in the formulation of evidence-based public health services and policies
 - d) Educate future leaders in public health research, service, policy and advocacy

4) Fields of Specialization

Students of the program may choose from any of the following major areas of specialization:

- a) Public Health
 - i. Epidemiology
 - ii. Medical Microbiology
 - iii. Nutrition
 - iv. Parasitology
 - v. Health Promotion and Education

5) Admission Requirements

- a) MPH/MSPH degree or any equivalent preparation relevant to the field of concentration from a recognized institution of higher learning. Those with a Master's degree other than MPH/MSPH must have at least 2 years of experience in public health.
- b) Excellent performance in the master's program, with emphasis on courses in the field of specialization.
- c) Must have demonstrated evidence of competence in the area of specialization, through written examination or interview administered by the DrPH Program Committee.
- d) Submission of an essay describing the applicant's previous and current work and an explanation of how the DrPH program is relevant to his future career.
- e) Letters of recommendation from two previous professors or employers.
- f) Must be 45 years old and below except in meritorious cases.
- g) Graduation Requirements
- h) Completion of at least 45 (Epidemiology, Medical Microbiology, Parasitology) or 46 academic units (Nutrition, Health Promotion and Education)

- i) Overall weighted average of 1.75 or better and a weighted average of 1.75 or better in the required courses in the field of specialization with no grade of 5.
- j) Passed the comprehensive examination.
- k) Must have orally defended original dissertation that constitutes a substantial contribution to knowledge in public health, and
- l) Submission of six (6) bound copies of the dissertation.

3. CONTINUING EDUCATION:

A. Understanding Continuing Education in the Philippines

1. The Continuing Professional Development (CPD) Act made Professional Development mandatory under R.A. 10912, July 21, 2016. (ANNEX-4)
 - a) Under the CPD law the competencies and qualifications of professionals for the practice of their professions are under the PQF, the AQRF, and the ASEANMRAs;
 - b) Ensure international alignment of competencies and qualifications of professionals through career progression mechanisms leading to specialization/sub-specialization;
 - c) Ensure the development of quality-assured mechanisms for the validation, accreditation, and recognition of formal, nonformal, and informal learning outcomes, including professional work experiences and prior learning;
 - d) Ensure maintenance of core competencies and development of advanced and new competencies, to respond to national, regional, and international labor market needs; and
 - e) Recognize and ensure the contributions of professionals in uplifting the general welfare, economic growth, and development of the nation.
- 2) CPD Programs consist of activities leading to the CPSP-CATS programs, which include the following:
 - a) **Formal learning**; curricular qualifications and teaching-learning requirements that take place in education and training institutions recognized by relevant national authorities, and which lead to diplomas and qualifications;
 - b) **Non-formal learning**; learning that has been acquired in addition or alternative to formal learning, which may be structured and made more flexible according to educational and training arrangements;
 - c) **Informal learning**; learning that occurs in daily life assessed, through the recognition, validation, and accreditation process, and which can contribute to a qualification;
 - d) **Self-directed learning**; learning activities such as online training, local/international seminars/non-degree courses, institution/company-sponsored training programs, and the like, which did not undergo CPD accreditation but may be applied for and awarded CPD units by the respective CPD Council

- e) **Online learning activities**; structured or unstructured learning initiatives, which make use of the internet and other web-based Information and Communications Technology solutions;
 - f) **Professional work experience**; non-formal, informal, or self-directed learning through involvement in various fields of practice resulting in the development of professional competency
- 3) Minimum requirements for SE Continuing Professional Development:
- a) Baccalaureate in Sanitary Engineering – Level 6
 - b) Registered Professional in PRC (Licensed)- Level 6
- 4) Approved CPD SE Courses, Training Programs, and CPD credit Equivalents (ANNEX - 5)

Section 2: Licensure and Regulatory Laws

1. Licensing Authorities:

- A. Professional Regulatory Board of Sanitary Engineering- Under R.A. 1364 (Sanitary Engineering Law)- for Competency
- B. Professional Regulation Commission- Commission administration and Registration of Sanitary Engineer
- C. Names and Contact Details of National/Regional Licensing Bodies (2024): (ANNEX-6)
- D. Website link of PRC: www.prc.gov.ph

2. LICENSURE REQUIREMENTS:

- A. Educational qualifications.
 - 1) A graduate of a four-year course in sanitary engineering or BSCE having taken major subjects in sanitary engineering from a school, institute, college, or university recognized by the Government or the State wherein it is established.
- B. Examination requirements.
 - 1) Be at least twenty-one years of age;
 - 2) Be a citizen of the Philippines;
 - 3) Be of good reputation and moral character
 - 4) Completion Course for Civil Engineers (Bridging program)
- C. Experience requirements:
 - 1) undergraduate on-job- training
 - 2) no professional experience needed

D. Renewal Processes and Continuing Education requirements

- 1) Upon passing the licensure examination the LERIS (Licensure Examination and Registration System) creates an account for the board passer. The account shall be the initial basis of renewal.
- 2) Renewal of License shall be based on the credit units accumulated and based on the Approved CPD SE Courses and Training Programs (See Tabulation above).

3. REGULATORY LAWS:

A. Key Regulations Governing Sanitary Engineering Practice.

- 1) R.A. 1364; An Act to Regulate the Practice of Sanitary Engineering in the Philippines
- 2) R.A. 8981; The PRC Modernization Act of 2000
- 3) R.A. 10912, July 21, 2016; Continuing Professional Development Act of 2016

Section 3: Codes and Standards Utilization

1. PUBLIC HEALTH CODES AND STANDARDS:

A. Public health codes and standards promote and safeguard the health of people. These codes and standards provide a legal and regulatory framework for various aspects of public health, from disease prevention to ensuring safe environments. Codes, Standards, Guidelines, and Best Practices ensure control of the spread of diseases and set guidelines for safe food, water, housing, and workplaces.

- 1) **International Public Health Standards.** Public health standards provide measurable guidelines and benchmarks for achieving optimal health outcomes developed by international organizations,
 - a) **WHO Standards:** Guidelines on nutrition, sanitation, environmental health, and disease management developed for global health practice.
 - b) **Occupational Safety and Health Standards:** These standards, enforced by entities like the Occupational Safety and Health Administration (OSHA), aim to protect worker health by reducing workplace hazards.
 - c) **Food and Drug Standards:** Food safety standards are implemented to prevent contamination, regulate food production, and ensure the safety of consumable products.
 - d) **Water Quality Standards** to ensure safe drinking water, these standards are often enforced by local governments and guided by international recommendations from the WHO. (ANNEX)
 - e) **Center for Disease Control and Prevention (CDC);** the national public health agency of the United States
- 2) **International Plumbing Codes and Standards** provide reference guidelines to ensure global plumbing systems' safety, reliability, and efficiency. These codes and standards cover the design, installation, maintenance, material

specifications, and inspection of plumbing systems. International plumbing codes and standards used in the Philippines:

a) World Plumbing Council (WPC) Guidelines

- i. **Purpose:** The WPC promotes the role of plumbing in protecting public health and the environment. It provides resources and guidelines to improve plumbing practices globally, including implementing sustainable technologies and methods.
- ii. **Contents:**
 - a) Promoting best practices in plumbing
 - b) Water conservation and management
 - c) Sanitation and hygiene improvement
 - d) Sustainable plumbing technologies

b) Uniform Plumbing Code (UPC)

- i. **Developed by:** the International Association of Plumbing and Mechanical Officials (IAPMO)
- ii. **Purpose:** The UPC is designed to provide consumers with safe and sanitary plumbing systems. It is widely adopted in North America and some Asian countries. The UPC covers the installation, inspection, and maintenance of plumbing systems.
- iii. **Contents:**
 - a. Health and safety considerations
 - b. Water conservation
 - c. Sanitary drainage systems
 - d. Venting systems
 - e. Cross-connection control
 - f. Graywater and reclaimed water systems

c) Green Plumbing Code Supplement (GPCS)

- i. **Developed by:** the International Association of Plumbing and Mechanical Officials (IAPMO)
- ii. **Purpose:** The GPCS provides guidelines for sustainable and environmentally friendly plumbing practices. It complements existing plumbing codes by integrating green technologies and practices.
- iii. **Contents:**
 - a. Water conservation and efficiency
 - b. Use of alternative water sources (e.g., rainwater, graywater)
 - c. Energy-efficient water heating
 - d. Sustainable materials and construction practices
 - e. List of relevant international standards
 - f. Adoption and adaptation of international standards in local practice.

d) International Plumbing Code (IPC)

- i. **Developed by:** International Code Council (ICC)
- ii. **Purpose:** The IPC provides comprehensive regulations for plumbing systems in residential, commercial, and institutional buildings. It is widely used in the United States and internationally, offering guidelines on water supply, sanitary drainage, stormwater management, and plumbing fixtures.
- iii. **Contents:**

- a. Water supply and distribution
 - b. Sanitary drainage systems
 - c. Storm drainage
 - d. Water heaters
 - e. Plumbing fixtures
 - f. Venting systems
- e) **JIS from the Japanese Standard Association-** Conduits, and pipes, and fittings standards in Japan and equivalencies for Philippine use.

2. INTERNATIONAL ENVIRONMENTAL MANAGEMENT STANDARDS:

A. International environmental management and protection standards are crucial for promoting sustainable practices and global engineering. Several organizations developed these standards, including the International Organization for Standardization (ISO) and the United Nations. Below are some key international standards related to the environment:

1) ISO 14000 Family (Environmental Management)

- a) **ISO 14001: Environmental Management Systems (EMS):** Specifies requirements for an effective EMS. It helps organizations improve their environmental performance through more efficient use of resources and reduction of waste.
- b) **ISO 14004:** Provides general guidelines on principles, systems, and support techniques for environmental management systems.
- c) **ISO 14006:** Guidelines for incorporating eco-design in EMS.
- d) **ISO 14064:** Focuses on the quantification, monitoring, reporting, and verification of greenhouse gas emissions.

2) United Nations Framework Convention on Climate Change (UNFCCC)

An international environmental treaty aimed at combating climate change by reducing greenhouse gas concentrations in the atmosphere. It led to the creation of key international agreements like the Kyoto Protocol and the Paris Agreement.

3) Kyoto Protocol

An international treaty that commits state parties to reduce greenhouse gas emissions is based on the premise that global warming exists and that human-made CO₂ emissions have caused it.

4) Paris Agreement

An agreement within the UNFCCC dealing with greenhouse gas emissions mitigation, adaptation, and financing, started in year 2020. Its long-term goal is to keep the increase in global average temperature well below 2°C above pre-industrial levels.

5) Stockholm Convention on Persistent Organic Pollutants

A global treaty aimed at eliminating or restricting the production and use of persistent organic pollutants (POPs), which are chemicals that remain in the environment for long periods, accumulate in living organisms and pose risks to human health and the environment.

6) Basel Convention

An international treaty designed to reduce the movements of hazardous waste between nations, especially from developed to less developed

countries, and to prevent the transfer of hazardous waste to places that cannot manage them safely.

7) Convention on Biological Diversity (CBD)

An international agreement aimed at ensuring the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of benefits arising from genetic resources.

8) Montreal Protocol

An international treaty designed to protect the ozone layer by phasing out the production of numerous substances responsible for ozone depletion, such as chlorofluorocarbons (CFCs).

9) ISO 50001: Energy Management Systems

Provides a framework for establishing energy management best practices to help organizations improve their energy efficiency, reduce costs, and lower greenhouse gas emissions.

10) ISO 26000: Guidance on Social Responsibility

Though not a certifiable standard, ISO 26000 provides guidance on how businesses and organizations can operate in a socially responsible way, including environmental responsibility.

11) Equator Principles

A risk management framework adopted by financial institutions for determining, assessing, and managing environmental and social risk in projects. It primarily applies to project finance and advisory services.

12) Global Reporting Initiative (GRI) Standards

Provides a comprehensive set of standards for sustainability reporting, including environmental, social, and governance (ESG) metrics. These standards help organizations report on their impacts on the environment.

13) World Health Organization (WHO) Guidelines

The WHO sets various environmental health standards, including those for air quality, drinking water quality, and waste management.

14) Environmental Protection Agency (EPA)- USA

3. NATIONAL STANDARDS:

A. National standards for sanitary engineering.

- 1) Civil Service Standards (ANNEX- 7)
- 2) Sanitation Code (PD 856) (ANNEX-8)
- 3) Uniform Plumbing Code of the Philippines
- 4) National Standard for Drinking Water (FDA) –(ANNEX-9)
- 5) Department of Trade and Industry (Bureau of Product Standards (DTI BPS)- National Standards Body (NSB) of the Philippines, operating under the Department of Trade and Industry (DTI); responsible for the development, promotion, and enforcement of Philippine National Standards (PNS) to ensure the quality, safety, and performance of products in the country. Enabling laws are as follows:
 - a) Republic Act No. 4109 (Standardization Law) governs the establishment of the BPS and outlines its authority to develop and implement standards in the Philippines.
 - b) Executive Order No. 292, also known as the Administrative Code of 1987, further supports the BPS's role within the DTI.

- 6) DAO 2016-8; Water Quality Guidelines and General Effluent Standards of 2016 (ANNEX-10)
- 7) DAO 2021- 19 Updated Water Quality Guidelines (WQG) and General Effluent Standards (GES) for Selected Parameter (ANNEX- 11)
- 8) DENR-Environment MB Outside Air Quality Index (AQI) (ANNEX-12)
- 9) DENR and LGUs- solid waste management standards (R.A. 9003) (ANNEX-13)
- 10) DOLE- Occupational Safety and Health Standards (ANNEX- 14)
- 11) Fire Code of the Philippines IRR 2019 (ANNEX-15)
- 12) Philippine environmental policy, Presidential Decree No. 1151, s. 1977 (ANNEX-16)
- 13) Establishing an Environmental Impact Statement System, PRESIDENTIAL DECREE No. 1586 (ANNEX -17)
- 14) Other Standards (RESERVED)

B. Key differences between national and international standards.

- 1) Climate
- 2) Culture
- 3) Laws
- 4) Religious Considerations
- 5) Economics
- 6) Engineering considerations
 - a) Material Acceptance
 - b) Manufacturing
 - c) Importation

4. Implementations and compliance: (RESERVED)

Section 4. Local Laws on Permits

1) Permit Requirements:

- a) Types of permits required by the government for sanitary engineering activities.
 - i. Environmental Compliance Certificate (ECC): Issued by the Department of Environment and Natural Resources (DENR), the ECC is required for projects with potential environmental impacts. It is necessary for projects like water treatment plants, sewage systems, and waste disposal facilities. The process involves submitting an Environmental Impact Assessment (EIA) to evaluate the viability of the project's environmental effects.
 - ii. **Laws:** Environmental Impact Statement (EIS) System (Presidential Decree No. 1586).
- b) **Water Permit:**
 - i. Required for projects that extract water from natural sources like rivers, lakes, or groundwater. This permit is issued by the National Water Resources Board (NWRB), ensuring that water use is regulated and sustainable.
 - ii. **Laws:** Water Code of the Philippines (Presidential Decree No. 1067).
- c) **Building Permit:** Issued by the local government unit (LGU) where the project is located.
 - i. The building permit ensures compliance with the National Building Code of the Philippines. It covers the construction of sanitary infrastructure,

including plumbing systems, sewage systems, and water treatment facilities.

- ii. **Laws:** Presidential Decree No. 1096 (National Building Code).
- d) **Sewerage, wastewater treatment, and Sanitation Clearance:** These agencies regulate the design and operation of sewage and sanitation systems to ensure public safety.
 - i. Sewerage systems shall obtain permits from the LGU
 - ii. For projects related to wastewater management, clearance from the Metropolitan Waterworks and Sewerage System (MWSS)
 - iii. Permit from the Local Water Utilities Administration and the local water district are required.
- e) **Sanitary Permit:**
 - i. A sanitary permit, issued by the local health office, is required for facilities related to public sanitation, such as sewage treatment plants or waste disposal systems.
 - ii. This permit ensures that the operation meets public health standards in the Sanitation Code of the Philippines (PD 856).
- f) **Zoning Clearance:**
 - i. This is issued by the LGU's planning and development office to ensure that the proposed sanitary project complies with the zoning ordinances of the municipality or city. It determines whether the project can be developed in the designated area.
- g) **Fire Safety Evaluation Certificate (FSEC):** The Bureau of Fire Protection (BFP) (RA 9514) evaluates the design for fire safety. (ANNEX- 15)
 - i. Life safety engineering
 - ii. Automatic Fire Sprinkler system
 - iii. This is required for infrastructure that houses hazardous materials or involves fire risks, and indoor waste treatment facilities.
- h) **Wastewater Discharge Permit:**
 - i. For projects discharging wastewater into bodies of water, a permit is required from the DENR to ensure the water quality is not compromised. This is in line with the Philippine Clean Water Act of 2004 (RA 9275).
- i) **Process Overview:**
 - i. **Initial Consultation:** Developers typically begin by consulting with the DENR and the LGU to assess environmental impacts and zoning requirements.
 - ii. **Submission of Plans:** Engineers must submit detailed project designs, including water, sewage, and waste management systems, to the relevant regulatory bodies for review.
 - iii. **Site Inspections:** Various agencies conduct site inspections to ensure compliance with safety, environmental, and sanitary standards.
 - iv. **Issuance of Permits:** Once the project meets all regulatory standards, permits are issued to begin construction and operation.
 - v. Application processes for other necessary documentation.

2) Authority Contacts:

- a) Contact information for local permitting authorities
 - i. The National laws on Codes, Standards, Guidelines, and Best Practices are with the government agencies involved in Implementing Rules and

- regulations, however, the function of issuing permits has been devolved to the local government units (LGU)
- ii. The permitting authorities shall be the LGU area involved.
- b) Inspection requirements and processes.
- i. The National laws on Codes, Standards, Guidelines, and Best Practices are with the government agencies involved in Implementing Rules and regulations, however, the function of issuing permits has been devolved to the local government units (LGU)
 - ii. The Inspection and conduct of visits are under the responsibility of the LGU
- 3) Compliance and inspections:
- a) **Compliance:** Ensuring that industries, communities, and health facilities comply with public health and environmental protection codes can be difficult, especially in regions with limited resources.
 - b) **Updating Standards:** Public health standards and environmental regulations must evolve to keep up with emerging threats (e.g., pandemics, environmental changes) and new scientific evidence.
 - c) **Enforcement:** In some regions, enforcement of public health codes and environmental laws needs to be improved particularly on infrastructure and/or funding.

Section 5: Design Parameters

I. PUBLIC HEALTH ENGINEERING

1. Sanitation

A. Sanitation Code Presidential Decree No. 856 (See ANNEX 8)

Chapter I	-	General Provisions
Chapter II	-	Water Supply
Chapter III	-	Food Establishments
Chapter IV	-	Markets and Abattoirs
Chapter V	-	Public Laundry
Chapter VI	-	School Sanitation and Health Services
Chapter VII	-	Industrial Hygiene
Chapter VIII	-	Public Swimming or Bathing Places
Chapter IX	-	Rest Areas, Bus Terminals, Bus Stops, and Service Stations
Chapter X	-	Camps and Picnic Grounds
Chapter XI	-	Dancing Schools, Dance Halls, and Night Clubs
Chapter XII	-	Tonsorial and Beauty Establishments

Chapter XIII	-	Massage Clinics and Sauna Bath Establishments
Chapter XIV	-	Hotels, Motels, and Apartments, Lodging, Boarding or Tenement, Houses, and Condominiums
Chapter XV	-	Port, Airport, Vessel, and Aircraft Sanitation
Chapter XVI	-	Vermin Control
Chapter XVII	-	Sewage Collection and Disposal, Excreta Disposal and Drainage
Chapter XVIII	-	Refuse Disposal
Chapter XIX	-	Nuisances and Offensive Trades and Occupations
Chapter XX	-	Pollution of the Environment
Chapter XXI	-	Disposal of Dead Persons

B. Communicable Diseases Control Engineering (DOH, Health Insurances and Social Security, LGUs- Health Authorities)- International Classification of Diseases (ICD-11)

- 1) Prevention
- 2) Causative Agent
- 3) Transmission of Communicable diseases
- 4) Engineering Control

2. Water Supply and Distribution

A. Source of Water:

The drinking water sources in the Philippines typically include surface water (lakes, rivers) and groundwater (wells). Protecting these sources is the first step in ensuring safe drinking water. This involves reducing pollution from industrial, agricultural, and residential activities.

- 1) **Surface Water:** Rivers, lakes, reservoirs; requires treatment for potability.
- 2) **Groundwater:** Wells and springs; may require treatment depending on water quality.
- 3) **Rainwater Harvesting:** Supplementary source, particularly in areas with rainwater plentiful.
- 4) **Other Sources and Alternatives:** Recycled water and non-potable water use

B. Water Demand Estimation

1) Per Capita Consumption:

- a) Water demand consumption is based on types of Area or Mixed Building development Occupancies
- b) Generally, 100-150 liters per capita per day (LPCD) for domestic use in urban areas.

- 2) **Population Projections:** Based on census data and future growth projections to determine the required capacity of the system.
- 3) **Peak Demand:** Usually, 1.5 to 2 times the average daily demand to accommodate fluctuations.
- 4) Other Uses of Water that shall contribute to the projected total water demand
- 5) Other Methods of Water Demand Estimation

C. Generation and Allocation of Usable Water:

- 1) Potable Water
- 2) Purified water for Industrial, Pharmaceutical, Clean rooms, and Healthcare facilities use
- 3) Non-potable Water
- 4) Industrial water
- 5) Firefighting Water
- 6) Recycled Water
- 7) Irrigation Water

D. Water treatment

The treatment of water involves the following:

- 1) Coagulation and Flocculation: Chemicals (like alum) are added to the water to bind small particles together, forming larger particles (flocs).
- 2) Sedimentation: The flocs settle at the bottom of the tank, and clear water moves to the next stage.
- 3) Filtration: Water passes through filters (sand, gravel, activated carbon) to remove any remaining particles. Nano filtration and ultrafiltration,
- 4) Disinfection: Chlorine or other disinfectants are added to kill pathogens such as bacteria, viruses, and parasites. This ensures the water remains safe until it reaches consumers.
- 5) Additional Treatment: In some cases, more advanced techniques like, nanofiltration, reverse osmosis or UV treatment may be used to remove additional contaminants (e.g., in areas with high contamination).

E. Transmission and Distribution Systems

1) Transmission:

- a) **Pipe Material:** Common materials include PVC, HDPE, ductile iron, and steel.
- b) **Pipe Sizing:** Based on hydraulic calculations to ensure adequate pressure and flow, considering friction losses, elevation differences, and demand.
- c) **Pressure Requirements:** Typically, 10 to 30 meters of water head (1 to 3 bar) at consumer taps.
- d) **System Redundancy**
 - i. **Looped Networks:** Designing distribution networks in loops to ensure service continuity, and minimize pressure fluctuations during, and for maintenance or repair activities.

- ii. **Backup Sources:** Multiple sources or interconnections with neighboring systems for reliability.

2) Pumping Stations

- a) **Location:**
- e) **Storage:** Elevated tanks and reservoirs designed to meet daily or emergency needs, usually 15-25% of the daily demand.
- b) **Pumps:** Designed to meet peak demand flow rates and pressure requirements.
- c) **Standby Power:** Provision for generators in case of power outages, especially in critical installations.

3) Water Quality Standards

- a) **Philippine National Standards for Drinking Water (PNSDW):** Specifies acceptable levels for contaminants (physical, chemical, biological) to ensure safe drinking water.
- b) **Treatment Processes:** Depending on the source, may include filtration, chlorination, fluoridation, and other treatments to meet PNSDW.

4) Non-Revenue Water (NRW)

- a) **Loss Management:** Systems designed to minimize NRW, which includes leakages, illegal connections, and metering inaccuracies. Target NRW levels are

5.) Legal and Regulatory Compliance

- a) **Local Government Code of 1991:** Guidelines for water service provision by local government units (LGUs).
- b) **National Water Resources Board (NWRB):** Issues water permits and regulates water use.

6) Sustainability Considerations

- a) **Environmental Impact Assessment (EIA):** Required for large-scale projects to assess and mitigate environmental impacts.
- b) **Climate Resilience:** Designing systems to withstand extreme weather events like typhoons and droughts, considering the Philippines' vulnerability to climate change.

7.) Fire Flow Requirements

- a) **Fire Hydrants:** Placement and design to provide adequate flow for firefighting, typically requiring higher pressures and flows than domestic use.

F. **Designing a building water distribution system** involves several key parameters to ensure efficient water supply, pressure management, and hygiene. Below are the critical design parameters:

1) Water Demand Estimation

- a) **Fixture Units:** Water demand is calculated based on the number and type of plumbing fixtures (e.g., sinks, showers, toilets). Each fixture is assigned a value in fixture units (FU), which corresponds to water flow rates.
- b) **Peak Demand:** The system must be designed to meet peak usage, considering both residential and commercial settings.
- c) **Diversity Factor:** Since not all fixtures are used simultaneously, a diversity factor is applied to adjust the demand downward.

2) Pipe Sizing

- a) **Pipe Material:** Common materials include copper, PVC, and PEX. The material affects flow velocity, pressure loss, and durability.
- b) **Pipe Diameter:** Larger diameters reduce friction losses and maintain adequate flow rates, especially for longer distances.
- c) **Flow Rate:** Calculated based on fixture demand, pipe sizing is done to maintain a proper flow rate (measured in gallons per minute or liters per second) without excessive pressure drops.

3) Water Pressure

- a) **System Hydraulic Calculations:** Pressure Losses occur due to friction in pipes, fittings, and valves. Calculations must account for these to ensure the required pressure at fixtures.
- b)
- c) **Static and Dynamic Pressure:** Static pressure refers to the pressure when no water is flowing, while dynamic pressure occurs when water is flowing. The system must be designed to maintain adequate pressure for all fixtures.
- d) **Pressure Requirements:** For residential buildings, a typical range is 30-60 psi (pounds per square inch). Commercial buildings may require higher pressures, especially for tall buildings.

4) Pumping Requirements

- a) **Transfer Pumps:** pumps used to transfer water from source/tank to other reservoirs
- b) **Booster Pumps:** In multi-story buildings, booster pumps are used to maintain adequate pressure in upper floors, ensuring that water reaches all levels.
- c) **Pump Sizing:** Pump size and capacity are determined based on the flow demand and the total dynamic head (vertical distance water needs to be pumped)
- d) **System Zoning** In tall buildings, zoning is used to manage pressure. The building may be divided into pressure zones where each zone has its own pumping and pressure-regulating system to avoid excessive pressure on lower floors.

5. Hot and Cold-Water Systems

- a) **Hot Water Distribution:** Hot water should be distributed efficiently with minimal losses. Insulation of hot water pipes is critical for energy efficiency.
- b) **Re-circulation Systems:** For larger buildings, a hot water re-circulation system may be necessary or provide instant hot water at fixtures, preventing water waste.

6. Backflow Prevention

- a) **Devices:** Backflow preventers, like check valves or air gaps, are installed to prevent contamination of potable water. This is critical in systems with connections to irrigation or fire suppression systems.

7. Water Quality Considerations

- a) **Filtration and Treatment:** Depending on the source of the water, filtration, chlorination, or other treatments may be required to ensure potable water quality.
- b) **Water-related Disease Prevention:** Measures must be taken to prevent microbial growth in water systems, even in hot water systems.

8. Storage Tanks

- a) **Water Storage:** In areas with unreliable water supply or in high-rise buildings, water storage tanks are used to ensure a continuous supply during peak hours or emergencies.
- b) **Sizing:** Storage capacity is based on the estimated water consumption and the building's size and purpose.

9. Compliance with Codes and Standards

- 1) **Building developers and owners are required to comply with the Green Building code** requirements during the design, construction, and operation phases. The code is designed to complement existing environmental laws, such as the Philippine Clean Air Act, Clean Water Act, and Solid Waste Management Act, to ensure holistic sustainability efforts in the building sector.
- 2) **Plumbing Codes:** Uniform Plumbing Code of the Philippines (UPCP)
- 3) The system design must comply with local plumbing codes (e.g., International Plumbing Code, Uniform Plumbing Code) and standards
- 4) **Health and Safety Standards:** Proper design ensures compliance with health regulations, particularly regarding potable water quality and backflow prevention.
- 5) **Occupancy Type/s Consideration:** Each building type (residential, commercial, industrial) may have specific requirements based on occupancy and usage patterns. The goal is to ensure a reliable, efficient, and safe water distribution system.

G. Fire Protection Design Standards:

- 1) NFPA standards (as updated)
- 2) Fire Code of the Philippines Implementing Rules and Regulations (R.A. 9514; IRR 2019)

II. ENVIRONMENTAL ENGINEERING

A. **Design parameters for a sewage treatment plant (STP)** depend on various factors including the volume of sewage, wastewater characteristics, environmental regulations, and treatment objectives. Here are the key design parameters to consider:

1) Flow Rate (Q)

- a) **Daily Flow (m^3/day):** Total volume of sewage expected daily.
- b) **Peak Flow Rate (m^3/day):** Maximum flow expected during peak hours.
- c) **Flow Variability:** Consider diurnal and seasonal flow variations.

2) Sewage Characteristics

- a) **Biochemical Oxygen Demand (BOD_5):** Amount of oxygen required by microorganisms to break down organic matter over five days (mg/L).
- b) **Chemical Oxygen Demand (COD):** Total oxygen required to chemically oxidize all organic and inorganic matter (mg/L).
- c) **Total Suspended Solids (TSS):** The concentration of suspended solids in sewage (mg/L).
- d) **Total Nitrogen and Phosphorus:** Nutrient concentrations that can contribute to eutrophication if released untreated.
- e) **pH Level:** Measurement of acidity or alkalinity of the wastewater.
- f) **Fats, Oils, and Grease (FOG):** May require specialized treatment to remove.

- g) **Nutrients:** Nitrogen (N) and phosphorus (P) concentrations, which can cause eutrophication.

3) Hydraulic Retention Time (HRT)

- a) Time the sewage stays in each treatment process, influencing microbial growth and treatment efficiency. For biological processes, retention times can range from a few hours to a few days.

4) Sludge Production and Handling

- a) The quantity of sludge produced during the treatment process.
- b) **Sludge Retention Time (SRT):** The average time sludge stays in the treatment system.
- c) **Sludge Treatment:** Methods like digestion (aerobic/anaerobic), dewatering, or composting.

5) Aeration Requirements

- a) Aerobic biological treatment processes require sufficient oxygen supply, so oxygen demand must be calculated based on BOD and COD loadings.

6) Surface Loading Rate

- a) For sedimentation tanks or clarifiers, this is the rate at which wastewater flows per unit surface area ($\text{m}^3/\text{m}^2/\text{day}$).

7) Organic Loading Rate

- a) Expressed as $\text{kg BOD}_5/\text{m}^3/\text{day}$, it defines the amount of organic matter applied to the biological treatment process.

8) Treatment Technology-Specific Parameters

- a) **Activated Sludge Process:**
 - i. Food-to-Microorganism Ratio (F/M)
 - ii. Mixed Liquor Suspended Solids (MLSS) concentration
- b) **Trickling Filter:**
 - i. Hydraulic and organic loading rates
 - ii. Filter media depth
- c) **Membrane Bioreactor (MBR):**
 - i. Membrane flux ($\text{L}/\text{m}^2/\text{h}$)
 - ii. Transmembrane pressure

9) Effluent Quality Standards

- a) These are regulatory limits for BOD, COD, TSS, nitrogen, phosphorus, pathogens, and other pollutants in the treated water.

10) Energy Requirements

- a) Power needed for pumps, blowers, mixers, and other equipment. Energy efficiency should be considered in the design.

11) Safety and Environmental Considerations

- a) Noise, odor control, and measures for reducing environmental impact.

B. **Design parameters for Commercial and industrial wastewater treatment** vary based on the treatment process used (primary, secondary, tertiary) and the characteristics of the wastewater. However, treatment shall vary depending on the characteristics of the wastewater. Below are the key parameters commonly considered when designing a wastewater treatment plant (WWTP):

1) Flow Rate

- a) **Average Daily Flow (ADF):** The expected average volume of wastewater (m^3/day).
- b) **Peak Flow Rate:** Maximum flow during peak usage periods (m^3/day).
- c) **Diurnal Flow Variation:** Hourly flow variations throughout the day.

d) Wastewater Characteristics

- e) **Biochemical Oxygen Demand (BOD₅)**: Oxygen demand by microorganisms to degrade organic matter (mg/L).
- f) **Chemical Oxygen Demand (COD)**: Total oxygen demand required to oxidize organic and inorganic compounds (mg/L).
- g) **Total Suspended Solids (TSS)**: Concentration of solids suspended in the wastewater (mg/L).
- h) **pH**: Acidity or alkalinity of the wastewater.
- i) **Nutrients**: Nitrogen (N) and phosphorus (P) concentrations, which can cause eutrophication.
- j) **Fats, Oils, and Grease (FOG)**: Often found in industrial or domestic wastewater.

2) Primary Treatment Parameters

- a) **Detention Time**: Time the wastewater spends in the primary clarifier (typically 2-3 hours).
- b) **Surface Overflow Rate**: The hydraulic loading rate to the clarifier ($\text{m}^3/\text{m}^2/\text{day}$).
- c) **Weir Loading Rate**: Flow rate per unit length of weir ($\text{m}^3/\text{day}/\text{m}$).
- d) **Sedimentation Velocity**: The velocity at which suspended solids settle.

3) Secondary Treatment Parameters

- a) **Activated Sludge Process**:
 - i. **Mixed Liquor Suspended Solids (MLSS)**: Concentration of suspended solids in the aeration tank (mg/L).
 - ii. **Food-to-Microorganism (F/M) Ratio**: Ratio of BOD applied to microorganisms ($\text{kg BOD}/\text{kg MLSS}/\text{day}$).
 - iii. **Sludge Retention Time (SRT)**: Average time solids remain in the system (days).
 - iv. **Hydraulic Retention Time (HRT)**: Time wastewater spends in the aeration tank (hours).
 - v. **Dissolved Oxygen (DO)**: Oxygen concentration in the aeration tank (2-4 mg/L).
- b) **Trickling Filters (SELDOM USED IN THE PHILIPPINES)**:
 - i. **Organic Loading Rate**: Amount of organic material per unit volume of filter media ($\text{kg BOD}/\text{m}^3/\text{day}$).
 - ii. **Hydraulic Loading Rate**: Volume of wastewater applied per unit area of the filter ($\text{m}^3/\text{m}^2/\text{day}$).
- c) **Membrane Bioreactor (MBR)**:
 - i. **Membrane Flux**: The volume of wastewater passing through the membrane per unit area per unit time ($\text{L}/\text{m}^2/\text{h}$).
 - ii. **Transmembrane Pressure**: Pressure required to drive the wastewater through the membrane.

4) Tertiary Treatment Parameters

- a) **Filtration**:
 - i. **Filter Loading Rate**: Flow rate through the filter medium ($\text{m}^3/\text{m}^2/\text{day}$).
 - ii. **Backwash Rate**: Rate of water used to clean the filters.
- b) **Decontamination**:
 - i. **Chlorine Dose**: Amount of chlorine applied (mg/L).
 - ii. **Contact Time**: Time wastewater is in contact with disinfectant (minutes).
 - iii. **Ultraviolet (UV) Intensity**: UV dosage applied for pathogen removal (mJ/cm^2).

iv. **Ozone exposure:** for destruction of pathogenic cells

5) Sludge Treatment and Disposal

- a) **Sludge Production:** Amount of sludge generated (kg dry solids/day).
- b) **Sludge Thickening:** Increase in sludge solids concentration.
- c) **Sludge Digestion:** Anaerobic or aerobic digestion to reduce sludge volume and pathogens.
- d) **Sludge Dewatering:** Removal of water from sludge before disposal (e.g., via centrifuge, belt press).

6) Energy and Aeration Requirements

- a) **Aeration Efficiency:** Power required to provide oxygen for biological processes (kg O₂/kWh).
- b) **Blower Capacity:** Airflow rate required for aerobic processes (m³/min).

7) Nutrient Removal

- a) **Nitrogen Removal:**
 - i. **Ammonia-N:** Concentration of ammonia nitrogen.
 - ii. **Nitrification/Denitrification:** Process parameters for converting ammonia to nitrate and nitrate to nitrogen gas.
- b) **Phosphorus Removal:** Use of chemical precipitation (e.g., alum, ferric chloride) or biological processes.

8) Effluent Quality Standards

- a) **BOD, COD, TSS:** Regulatory limits on treated effluent (mg/L).
- b) **Nutrient Concentrations:** Limits on nitrogen and phosphorus in effluent (mg/L).
- c) **Pathogen Levels:** Limits on coliform bacteria and other pathogens in treated water.

9) Hydraulic and Organic Loading

- a) **Hydraulic Loading:** Total volume of wastewater per unit area or per unit volume in various treatment units (m³/m²/day or m³/m³/day).
- b) **Organic Loading:** Organic matter (BOD, COD) applied to treatment processes, expressed per unit volume or unit area (kg BOD/m³/day or kg BOD/m²/day).

10) Environmental and Safety Considerations

- a) **Odor Control:** Use of biofilters, chemical scrubbers, or activated carbon filters.
- b) **Noise and Vibration:** Mitigating mechanical noise from blowers, pumps, and other equipment.
- c) **Environmental Impact:** Minimizing emissions, discharges, and energy usage.

11) Design Redundancy and Reliability

- a) **Standby Units:** Additional units for key equipment to ensure continuous operation during maintenance or breakdowns.
- b) **Emergency Overflow Systems:** Handling situations where flow exceeds design capacity.

C. **Solid Waste Management (SWM) system** involves parameters that ensure proper collection, treatment, and disposal of solid waste while minimizing environmental and public health impacts. These parameters vary depending on the type of waste (municipal, industrial, hazardous, etc.), local regulations, and available technologies. General Design Parameters for Solid Waste Management:

1) Waste Generation Rate

- a) **Per Capita Waste Generation:** The average amount of waste generated per person per day (kg/capita/day).
- b) **Waste Composition:** The types of waste generated, including organic waste, plastics, paper, metals, glass, and hazardous materials. Waste characterization helps determine appropriate treatment methods.
- c) **Total Waste Generation:** Total volume of waste generated by a specific community or industry (tons/day).

2) Waste Collection and Transportation

- a) **Collection Frequency:** How often waste is collected (daily, weekly, etc.), which depends on waste type, population density, and local practices.
- b) **Collection Methods:** Manual or mechanical (e.g., door-to-door, communal bins, curbside collection).
- c) **Vehicle Capacity:** Size and type of waste collection vehicles (m³ or tons) to handle the volume of waste.
- d) **Routing Efficiency:** Optimizing collection routes to minimize fuel consumption, time, and costs.
- e) **Transfer Stations:** Locations where waste is temporarily stored and compacted before being transported to disposal or treatment sites. Design parameters include capacity (tons/day), compaction ratio, and storage time.

3) Waste Segregation and Recycling

- a) **Segregation at Source:** Promoting the separation of waste into categories like organic, recyclable, and hazardous waste at the point of generation.
- b) **Recycling Rate:** The percentage of waste materials that can be recovered and reprocessed.
- c) **Sorting and Processing Facilities:** Design parameters include facility capacity (tons/day), type of sorting equipment (manual, mechanical, or optical), and recovery efficiency.

4) Waste Processing and Treatment

- a) **Composting:**
 - i. **Organic Waste Fraction:** The percentage of biodegradable material in the waste stream.
 - ii. **Composting Technology:** Windrow, in-vessel, or vermicomposting.
 - iii. **Composting Time:** The time required for waste to break down into compost (typically 2-6 months).
 - iv. **Moisture Content:** Optimal moisture level (typically 40-60%) for microbial activity.
 - v. **Ratio:** Carbon-to-nitrogen ratio, ideally between 25:1 and 30:1 for efficient composting.
- b) **Anaerobic Digestion (Biogas Production):**
 - i. **Organic Loading Rate (OLR):** The amount of organic matter fed into the digester (kg volatile solids/m³/day).
 - ii. **Hydraulic Retention Time (HRT):** The time waste stays in the digester, influencing methane production (days).
 - iii. **Biogas Yield:** Volume of biogas generated per unit of organic waste (m³/kg of waste).

5. Waste Disposal (Landfilling)

- a) **Landfill Site Selection:** Criteria include proximity to population centers, groundwater level, soil type, and environmental impact.
- b) **Landfill Capacity:** The volume of waste the landfill can accommodate (m³ or tons).

- c) **Landfill Liner System:** Use of impermeable liners (clay, synthetic) to prevent leachate from contaminating groundwater.
- d) **Leachate Collection and Treatment:** Systems to collect and treat liquid draining from the landfill (leachate generation rate: typically 0.2-0.5 m³/ton of waste).
- e) **Landfill Gas Management:** Collection and treatment of methane and other gases generated by anaerobic decomposition, often used for energy generation.
- f) **Landfill Compaction Rate:** Compacting waste to reduce its volume (compaction density: kg/m³).
- g) **Landfill Cover:** Daily and final cover materials to reduce odor, pests, and gas emissions.

6. Hazardous Waste Management

- a) **Waste Classification:** Identification of hazardous wastes (e.g., medical, industrial, electronic) based on their chemical, biological, or radioactive properties.
- b) **Storage and Containment:** Proper containers and storage facilities to isolate hazardous waste from the environment.
- c) **Treatment Methods:** Depending on the type of hazardous waste, treatments may include incineration, chemical neutralization, or encapsulation.

7. Environmental and Public Health Considerations

- a) **Odor Control:** Systems to minimize odors at transfer stations, processing plants, and disposal sites (e.g., biofilters, chemical scrubbers).
- b) **Dust and Air Pollution:** Measures to control emissions from incineration or material handling, including particulate matter and gaseous emissions.
- c) **Pest and Vermin Control:** Systems for controlling rodents, insects, and birds at waste handling sites.
- d) **Noise Control:** Limiting noise pollution from equipment and transport vehicles.
- e) **Groundwater and Surface Water Protection:** Systems to prevent leachate from contaminating water sources.

8. Energy and Resource Recovery (FOR LEGISLATION) (RESERVED)

9. Regulatory Compliance and Monitoring

- a) **Monitoring Systems:** Continuous monitoring of emissions (e.g., air, water, soil) to ensure compliance with environmental regulations.
- b) **Waste Reporting:** Regular reporting of waste quantities, recycling rates, and disposal methods.
- c) **Compliance with National/Local Regulations:** Adherence to laws and regulations governing waste management, including hazardous waste rules, emissions standards, and landfill operation guidelines.

10) Public Awareness and Participation

D. DENR Discharge Parameters (ANNEXES 10)

E. Stream and Receiving water parameters (ANNEX 11)

F. Outside Air Quality Index (AQI) (ANNEX-12)

G. Other Parameters in Sanitary Engineering

Section 6: MRSs Compliance

1. Mutual Recognition Agreements:

- A. Overview of MRSs applicable to sanitary engineering within ASEAN.

- 1) Establishment of the qualifications of professional services suppliers to be mutually recognized by signatory member countries, hence facilitating an easier flow of professional services in the ASEAN region on Public Health and Environmental Engineering.
 - 2) As provided in the ASEAN Framework Agreement on Services (AFAS), Article V of the ASEAN member countries may recognize the education, experience obtained, requirements met, and license granted in other ASEAN member countries, for licensing or certification of service suppliers.
- B. Processes for recognition of qualifications and licensure across member states.
- 1) Has completed a recognized engineering program or its equivalent in a university or school
 - 2) accredited by CHED
 - 3) Possesses a current and valid PRC professional registration or license to practice engineering in the Philippines
 - 4) Has gained experience of not less than seven years of active and practical engineering experience
 - 5) Has spent at least two years in responsible charge of significant engineering works within the seven years of prescribed practice
 - 6) Has complied with the CPD program of the Philippines
 - 7) Has confirmed signature on the statement of compliance with codes of ethics
 - 8) Has not been charged or convicted of any crime involving moral turpitude and illegal practices

2. Harmonization Efforts:

- A. Ongoing efforts to harmonize standards, codes, and regulations.
- 1) Collation of Local Codes, standards, Guidelines, and Best Practices
 - 2) Integrating various engineering, technology, and technicians for competency development, re-organization, and global competitiveness
 - 3) Incorporation and Inclusion of laws implementing rules and regulations as part of Codes, Standards, and Guidelines
- B. Platforms for collaboration and information exchange.

Section 7: Safety Standards and Practices

1. Occupational Safety and Health:
 - a. Public Health Engineering, where Sanitary engineers take the lead role.
 - i. Construction safety and health engineering
 - ii. Industrial hygiene
 - iii. Life Safety Engineering and Health
 - iv. Sanitation
 - b. Ascribed engineering and technologists practices
 - i. Sanitary engineering (Domestic, work area safety and comfort, and Hazardous wastes)
 - ii. Chemical Engineering (Chemical and Hazardous Waste)
 - iii. Mechanical Engineering (equipment trustworthiness, manufacturing issues,
 - iv. Electrical engineering (Power related hazards)

- v. Electronics and communication engineering (Domestic pumps control, Equipment Control, Communication, Fire detection, alarm and control on activation of fire pumps)
 - vi. Civil engineering (Structural integrity during emergencies)
 - vii. Architecture and Interior Design (Compliance with Life Safety Code)
 - viii. Registered Master Plumbing (Plumbing Trade practitioner on installation hazards)
- a. Safety standards under Sanitary engineering and other engineering practitioners:
- i. Sanitation Code of the Philippines
 - ii. Fire Code of the Philippines
 - iii. NFPA 101 (Life safety standards)

Section 8: Environmental Regulations

1. Environmental Impact:

- A. Regulations concerning the environmental impact of sanitary engineering projects.

Revised Procedural Manual, DAO-30-30 s 2007 (ANNEX-18)

- B. Procedures for conducting environment impact assessments.

Establishing an environmental impact statement system, including other environmental management-related measures and for other purposes; R.A. 1586, s. 1978 (ANNEX 17)

2. Sustainable Practices:

- A. Guidelines for implementing sustainable and eco-friendly practices in sanitary engineering.

The Green Building Code was introduced in 2016 as a supplementary measure to the National Building Code of the Philippines under Republic Act 9514 (Fire Code of the Philippines) and Republic Act 9729 (Climate Change Act). It is primarily enforced by the Department of Public Works and Highways (DPWH) and aims to make buildings more resource-efficient and environmentally friendly, in line with the global sustainability trend

Section 9: Technology and Innovation

1. Emerging Technologies:

- A. Overview of emerging technologies in the field of sanitary engineering.

1) TECHNOLOGIES IN THE FIELD OF WATER AND WASTEWATER TREATMENT

By Engineer Carlito Santos, JR

I. Technologies

Overview of existing and emerging technologies in the field of water and wastewater treatment

- A. Variants of Activated Sludge Process
 - 1. Sequencing Batch Reactor (SBR)
 - a. With Biological Nutrients Removal
 - b. With Chemical Supplementation
 - 2. Other Variants
- B. Moving Bed Biofilm Reactors (MBBR)
 - 1. With Biological Nutrients Removal
 - 2. With Chemical Supplementation
- C. Membrane Bioreactor (MBR)
 - 1. With Ultra Filtration
 - 2. With Chemical Supplementation
- D. Sludge Management
 - 1. Acceptance Unit for Raw Septage Treatment
 - 2. Secondary Treatment (Biological, Chemical and Tertiary Treatment for Handling of Filtrates from Acceptance)
 - 3. Unit Anaerobic Digestion
 - 4. Aerobic Digestion
- E. Disinfection Process
 - 1. Chlorination
 - 2. Ultraviolet Disinfection
 - 3. Ozonation
 - 4. Reverse Osmosis
- F. Natural and Low-Cost Technologies
 - 1. Ponds
 - a. Waste Stabilization Ponds
 - b. Facultative Ponds
 - c. Anaerobic Ponds
 - d. Maturation Ponds
 - 2. Use of Plants like Reed Beds
 - 3. Upflow Anaerobic Sludge Blanket (UASB)
- G. Granular Sludge Systems
 - 1. Anaerobic
 - 2. Aerobic
- H. Ion Exchange for Nutrients Removal Thru Application of Appropriate Resins
- I. Microbiological Applications
 - 1. In the Treatment Process
 - 2. For Operations and Maintenance

II. Operations and Maintenance of Wastewater Treatment Plants

- A. Working knowledge on preliminary, primary, secondary, and tertiary treatment
 - B. Basic knowledge of sampling, onsite testing, and laboratory procedures for the analysis of fundamental parameters
- III. Research and Development
 - A. Interdisciplinary collaboration for experimentation of various treatment processes
 - B. Research on new treatments or improvements to existing technologies
- IV. Case Studies
 - A. Seven (7) years of significant practice in Sanitary Engineering (tabulated)
 - B. Two (2) years that showcase contributions made as a Sanitary Engineer in terms of design, project management, leadership, impact to society, and engineering skills (narrative form, no less than 2,000 words)

B. ADOPTION AND INTEGRATION OF NEW TECHNOLOGIES INTO PRACTICE.

- 1) Bioremediation (RESERVED)
- 2) Desalination Plants (RESERVED)
- 3) Flood Control system (Global City, Taguig) (RESERVED)

2. Research and Development:

A. Key research institutions and areas of ongoing research.

- 1) TESDA
- 2) DTI -BPS
- 3) PSSEI- Uniform Plumbing Code of the Philippines
- 4) Institution research in environmental engineering
 - a) PAGASA
 - b) DENR- EMB
- 5) Institution research on Public Health
 - a) DOH
- 6) Practitioner Researches (RESERVED)

B. Funding opportunities and collaboration platforms for innovation.

- 1) Infectious and Communicable Diseases Engineering Control- DOH,
- 2) PSSEI Various researches (RESERVED)

Section 10: Professional Networking and Associations

1. Professional Associations:

A. List of national and regional professional associations for electrical engineers.

- 1) PSSEI AND REGIONAL CHAPTERS
- 2) Integration of other associations under an AIPO following the PQF and CPSP; to include
 - a) Reorganizing the College of Fellows to focus on Specialization (CPSP-CATS)
 - b) Specialization Practices for ACPE certification

- c) Technologists and Technician
- B. Membership requirements.
 - 1) Registered Sanitary Engineer

2. Networking Opportunities:

- A. Conferences, seminars, and workshops for professional development.
 - 1) Integration as technologists and technicians to include the Sanitary Inspectors, Occupational Safety and Health officers, Pollution control officers, and Trade practitioners into an integrated organization.
 - 1) Training programs for the integrated professionals
- B. Platforms for peer-to-peer networking and knowledge exchange.
 - 1) Training programs for the integrated professionals
 - 2) CPD programs and events
 - 3) CPSP-CATS professional development programs

Section 11: Case Studies and Best Practices

1. Successful Projects:

- A. Case studies of successful sanitary engineering projects within ASEAN.

2) **PLUMBING / SANITARY SYSTEM OF ISLAND RESORT**

By Engineer Noel Yumol

Introduction:

An island resort is a hotel complex located on an island; in many cases, one luxury hotel may own the entire island. The island or an archipelago that contains resorts, hotels, overwater bungalows, restaurants, tourist attractions, and its amenities, and might offer all-inclusive accommodations. Its primary focus is on tourism services and offer leisure, adventure, and amusement opportunities.

Considering the project is in an island most of the utilities are not present such as water, sewerage, drainage, etc.

In order to address these issues, the system should be designed considering sustainability.

A. DATA IDENTIFICATION

General:

- Identify all necessary local and national codes and standards covered for the particular project.
- Determine rules and guidelines of the particular country or city.
- Secure the following test report and study: (by specialized entity)
 - a. Georesistivity
 - b. Hydrologic study
 - c. Weather cycle and condition
 - d. Site profile

- Determine bodies of water present in the area.
- Availability of material

I. Water Distribution System

- Determine or identify sources of potable water.
- Determine the capacity of potable water source versus demand
- Identify location of potable water storage tanks

II. Sewer and waste system

- Identify the waste generated from the project (in other words – toilet waste, kitchen, laundry etc.)
- Determine necessary and applicable waste water treatment system.

III. Storm drainage system

- Rainfall intensity / precipitation data
- Bodies of water
- Tributary area for rainwater catchment

B. DESIGN CONSIDERATION

I. Water Distribution System

- Design an efficient water distribution system – potable and non-potable.
- Consider deepwell construction or extraction of fresh ground water with proper water treatment to be use as potable water.
- Consider extraction of brackish water and provide proper water treatment system to provide potable water.
- Consider water recycling from STP treated water and use for water flushing and irrigation.
- Consider rain water harvesting and provide proper treatment to use as flushing water, irrigation water or even potable water.
- Use non-corrosive water storage tanks and piping.
- Use solar powered pumps / equipment, backed-up with efficient batteries.
- Use water efficient plumbing fixtures.

II. Sewer, Waste System

- Design an efficient sewer / waste water network system, considering operational and maintenance issues.
- Use proper waste water treatment for a particular waste water.
- Use efficient wastewater treatment system, low maintenance, low power and less chemical consumption.
- Minimized treated water disposal by recycling treated water for flushing and irrigation purposes.
- Excess sludge from sewage / waste water treatment plant shall be properly treated and use as soil conditioner.

III. Storm Drainage System

- Design an efficient site drainage system to prevent water ponding/flooding.
- If possible, have porous path walks or pavements to help groundwater recharge and reduce rainwater run-off.
- Consider a rainwater harvesting system, with proper treatment, and use the collected rainwater as flushing, irrigation, or potable water.

- Consider a detention tank or soak-away for the disposal of site rainwater run-off, preventing rainwater run-off from contaminating bodies of water. (sea or natural waterway)
- Collecting condensate water from aircon units, merging with non-potable water (with heat exchanger if necessary).

B. Key lessons learned and best practices. (RESERVED)

2. Innovative Solutions: (RESERVED)

Section 12: Legal and Ethical Considerations

1. Legal Framework:

- A. Overview of the legal framework governing sanitary engineering practice.
- 1) Shall follow R.A. 1364 (Sanitary Engineering Law)
 - 2) The practitioner shall be a graduate of BSSE/BSEnSE Compliant to CMO 98 s 2017
 - 3) Shall be registered with the PRC
- B. Key legal considerations for engineers working in different ASEAN countries. (RESERVED)

2. Ethical Dilemmas: (RESERVED)

- A. Common ethical dilemmas faced by Sanitary engineers.
- B. Guidelines for professionally resolving ethical issues.
