Section 1

Introduction and General Planning Requirements
1.1 **Purpose of This Volume**

This Volume sets out the requirements of the National Water Services Commission (SPAN) (referred to as the Commission in this document) for the planning, design and construction of sewage treatment plants. This Volume contains the following:

a) An overview of considerations and criteria for sewage treatment plant design.

b) Effluent discharge standards requirements and the capacity of different sewage treatment processes to meet these standards.

c) Requirements for the siting and sizing of sewage treatment plants.

d) Requirements for each stage of sewage treatment.

e) Minimum requirements for facilities ancillary to a sewage treatment plant.

f) Other special requirements for temporary treatment plants, treatment plants within buildings, homestead developments and exemptions for non-compliance with standards.

g) Requirements of sludge treatment process and disposal.

The owner must comply with the requirements set out in this volume when submitting an application for approval to the Commissioner.

This volume does not cover any aspect other than Sewage Treatment Plant requirements. All internal plumbing approvals need to be approved by Local Authorities.

1.2 **Who Should Use This Volume**

This Volume is primarily for owners, developers, consulting engineers and Public Authorities whose developments include sewage treatment plants.

1.3 **Related Reference Material**

This Volume does not cover all aspects of design and construction of sewage treatment plants. Where information is not covered in this volume, the designer shall follow the requirements given in MS 1228.

However, the information in this Volume shall take precedence over MS 1228 where similar aspects are covered in these documents or where there is conflicting information between the two documents.
The procedures for certification of sewerage services are given in the Malaysia, *Volume 2 Sewerage Works Procedures*.

All Standards references adopted during this revision exercise are compiled and given in Appendix B.

### 1.4 General Planning and Design Approval Requirements

The application procedures for sewage treatment plants approval shall follow the requirements given in MSIG Volume 2. In general, the application for approval of a treatment plant shall include:

a) Sufficient land area for the sewage treatment plants plus additional area to allow for extensions to the plant, where necessary.

b) Land of suitable configuration shall be provided.

c) Sufficient buffer zones.

d) The location of a sewage treatment plant in relation to a particular catchment area. The plant unit processes shall be located at an elevation which is not subject to flooding/wave action, or shall otherwise be adequately protected against all flooding/wave action.

e) Sufficient topographic features shall be included to indicate its location in relation to streams and the point of discharge of the treated effluent.

f) Schematic flow diagrams showing utility systems serving the plant processes and the flow through various plant units.

g) Pipeworks, including any arrangements for bypass from individual units. The direction of flow and the content in the pipes shall also be clearly and permanently painted onto all exposed piping works.

h) Hydraulic profiles showing the flow of sewage, supernatant liquor, and sludge.

i) Location, dimensions and elevations of all existing and proposed plant facilities.

j) Capacity of the effluent receiving drain/water course shall be able to cater for additional discharge flow from the treatment plant.

k) Consideration for odour and noise mitigation and control through good facility design, effective operation, containment, collection and treatment.

l) Point of discharge of treated effluent (effluent outfall) and elevations
of high and low water levels of the receiving watercourse to which the plant effluent is to be discharged.

m) Type, size, features, and operating capacity of all pumps, blowers, motors and other mechanical devices together with manufacturer catalogues.

n) Minimum, average and maximum hydraulic flows, velocities and top water level in profiles.

o) Accessibility, landscaping and fencing.

p) Flow measurement facilities.

q) Materials, dimensions and specifications.

r) Ground conditions including levels, type, groundwater level and safe bearing pressure of foundation.

s) Details of foundation and other structural design. Slope protection works are required, where applicable.

t) All other components of the sewage treatment plant.

u) A technical report, which covers the ‘whole life cost’ evaluation of the plant.

v) Process and instrumentation diagram.

w) Mass balance calculation

x) Clean and legible detailed drawings in standard format

y) Operation and Maintenance needs of the plant to be addressed at the early planning stage.

z) Where required, an EA or EIA report is needed to identify, predict, evaluate and communicate information concerning the adverse and beneficial impacts of the proposed treatment plant.

aa) HAZOP requirement is necessary to identify the safety and operability deficiencies in the design and operation of the treatment plant.

### 1.5 Guidelines for Design Calculations

Design calculation for all unit processes shall be in sequence starting from inlet works to biological treatments and sludge treatments as shown in Figure 5.1. The calculation shall include:

a) Sizing of each unit processes and all mechanical equipment involved.

b) Mass balance for overall system and each unit process.

c) Influent values.
d) Design influent and effluent values in compliance with Section 3.3.2.
e) Treatment plant shall be designed based on design flow.
f) Hydraulic profile across the treatment units to be indicated onto the drawings.
g) Each unit process must comply with the design parameters set in Section 5.
h) Calculation of PE to be based on Table 1.1.

Table 1.1 Recommended Population Equivalent

<table>
<thead>
<tr>
<th>Type of Premises/ Establishment</th>
<th>Population Equivalent (Recommended)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>5 per house</td>
</tr>
<tr>
<td>Commercial:</td>
<td>3 per 100 m² gross area</td>
</tr>
<tr>
<td>Includes offices, shopping complex, entertainment/ recreational centres, restaurants, cafeteria, theatres</td>
<td></td>
</tr>
<tr>
<td>Schools/ Educational Institutions:</td>
<td>0.2 per student</td>
</tr>
<tr>
<td>- Day schools/ Institutions</td>
<td>1 per student</td>
</tr>
<tr>
<td>- Fully residential</td>
<td>0.2 per non-residential student</td>
</tr>
<tr>
<td>- Partial residential</td>
<td>1 per residential student</td>
</tr>
<tr>
<td>Hospitals</td>
<td>4 per bed</td>
</tr>
<tr>
<td>Hotels with dining and laundry facilities</td>
<td>4 per room</td>
</tr>
<tr>
<td>Factories, excluding process water</td>
<td>0.3 per staff</td>
</tr>
<tr>
<td>Market (wet type)</td>
<td>3 per stall</td>
</tr>
<tr>
<td>Market (dry type)</td>
<td>1 per stall</td>
</tr>
<tr>
<td>Petrol kiosks/Service stations</td>
<td>15 per toilet</td>
</tr>
<tr>
<td>Bus terminal</td>
<td>4 per bus bay</td>
</tr>
<tr>
<td>Taxi terminal</td>
<td>4 per taxi bay</td>
</tr>
</tbody>
</table>

(Ref: Malaysian Standard 1228)
Table 1.1 - Recommended Population Equivalent (Cont)

<table>
<thead>
<tr>
<th>Type of Premises/ Establishment</th>
<th>Population Equivalent (Recommended)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mosque/ Church/ Temple</td>
<td>0.2 per person</td>
</tr>
<tr>
<td>Stadium</td>
<td>0.2 per person</td>
</tr>
<tr>
<td>Swimming pool/ Sports complex</td>
<td>0.5 per person</td>
</tr>
<tr>
<td>Public toilet</td>
<td>15 per toilet</td>
</tr>
<tr>
<td>Airport</td>
<td>0.2 per passenger</td>
</tr>
<tr>
<td></td>
<td>0.3 per employee</td>
</tr>
<tr>
<td>Laundry</td>
<td>10 per machine</td>
</tr>
<tr>
<td>Prison</td>
<td>1 per person</td>
</tr>
<tr>
<td>Golf course</td>
<td>20 per hole</td>
</tr>
</tbody>
</table>

(Ref: Malaysian Standard 1228)

1.6 Guidelines for Drawings

All drawings shall be of standard format and orientation. The drawings required include:

a) Overall development plan showing the whole sewerage system and plant location.

b) Site layout plan showing the arrangement of the plant, buffer zone, internal set backs and all neighbouring developments.

c) Site layout plans showing all the process units, main pipe runs, electrical conduit corridors, site services (water, drains, lighting, other services), roads and paving, landscaping, buildings, fencing and finished level contours (or spot levels). The set out and overall dimensions of the plant shall also be shown.

d) Site elevations of the plant with at least one section through the plant in each direction. These sections shall extend at least 30 m from the plant boundary and include an indication of the surrounding development (in block form only).

e) Process and instrumentation diagram (P&ID) showing all tanks, pipes, channels, valves, mechanical equipment, instrumentation and control loops. The P&ID can also act as a summary of the design. It provides key details of each piece of equipment, tank, piping, valves and instruments.
f) Hydraulic profile showing all hydraulic pathways through the plant including bypasses. Information to be shown includes pipe sizes, invert levels, flow velocities, tank coping level, top water level and freeboard. Top water level and velocities at minimum flow, average flow and peak flow under design load must be clearly indicated.

g) Schematic flow diagrams and mass balances showing flow through all process units in the plant.

h) General arrangement drawings of each unit process. These drawings shall be in sufficient details to clearly describe the shape, size and function of each unit. The drawings shall show the structure of the unit, piping, valves and fittings, instrumentation, mechanical and electrical equipment, buildings, handrails, stairs, ladders, step irons, site services such as water and lighting, adjoining paving, roadworks, fencing, drainage, etc. Drawings of all items should show the elevations, plan view and sectional view (horizontally and vertically), where applicable.

i) Details are required of any object that would affect the operation or maintenance of the plant that is not covered by a standard drawing.

j) Required to use standard symbols and legend formats for all drawings.
Figure 1.1 Typical Hydraulic Profile

Notes:
1. The levels shown are for indicative purposes only.
2. Actual levels shall be determined from hydraulic calculations of actual plant design and actual site survey.

NORMAL WATER LEVEL
HIGHEST FLOOD WATER LEVEL
FLOOD LEVEL IN RECEIVING WATERCOURSE
Figure 1.2 Typical Process and Instrumentation Diagram
Figure 1.3 Typical Process Flow Diagram
Figure 1.4 Typical Mass Balance Diagram

Figure 1.5 Typical Electrical Single Line Diagram