

Code of practice for

Design and installation of small sewage treatment works and cesspools —

(Formerly CP 302 and CP 302.200)

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British Water and Effluent Treatment Plant Association	Institute of Clerks of Works of Great Britain Inc.
Cement and Concrete Association	Institute of Water Pollution Control
Institute of Building Control Officers	Water Research Centre

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Foreword

This code of practice, prepared under the direction of the Building Services Standards Committee, encompasses the subject matter previously covered by codes of recommended practice for small sewage treatment works, CP 302:1972, and for cesspools, CP 302.200:1949. CP 302 and CP 302.200 are withdrawn.

The use of cesspools or of septic tanks without further treatment of their effluent is generally considered not to be good practice but it is recognized that in some situations such installations are the only practicable means of dealing with sewage.

The increasing and wider application of synthetic materials and the production of larger prefabricated (package) units has been recognized and the scope of the code has been extended to include treatment units to deal with sewage from populations of up to 1 000 persons.

New processes developed since the publication of the previous code, such as the rotary biological contactor, are now included and it is intended that the code should not inhibit the development and application of other suitable new processes.

The code gives guidance for those experienced in the design of small sewage treatment works. However, it is recognized that not all works are regularly designed by such persons and it is strongly recommended that specialist advice should be sought where appropriate, including where ground conditions are difficult, where there are likely to be abnormal flow or pollution loads, and for the design of tanks, and biological or other processes.

It is not within the scope of this code of practice to set out in detail the full operation and maintenance requirements of small sewage treatment works. Adequate maintenance is essential for even the smallest works to ensure that it produces the standard of effluent required, and instructions for proper operation and maintenance should be provided by the designer. For general guidance see National Water Council Technical Paper No. 4 "The Operation and Maintenance of Small Sewage Works".

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

This code of practice represents a standard of good practice and takes the form of recommendations. Compliance with it does not of itself confer immunity from relevant legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 42, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This code of practice deals with the design and installation of sewage treatment works suitable for the domestic discharge from domestic and industrial communities ranging from single households up to about 1 000 population equivalent and with the storage of sewage by means of a cesspool, the contents of which are periodically removed for disposal or treatment.

Domestic discharges are taken to include those from schools, hotels, restaurants, etc. but the code does not deal with the treatment of trade effluents, or the effluent from chemical closets.

General guidance only is given on good design and installation practice. Particular requirements will be determined by local conditions. The code's recommendations should be supplemented as required by skilled engineering advice based on a knowledge of sewage works practice and of local conditions.

Materials for tanks and other structures are not indicated on the diagrams, which are included for guidance on general proportions and details of inlets, outlets and other features, and should not be scaled.

2 References

The titles of the publications referred to in this British Standard are listed on the inside back cover.

A list of other standards of interest in this field is given in Appendix A.

3 Definitions

For the purposes of this code of practice the following definitions apply.

3.1

activated sludge

a flocculent microbial mass, produced when sewage is continuously aerated

3.2

aerobic action

a biological process promoted by action of bacteria in the presence of dissolved oxygen

3.3

anaerobic action

a biological process promoted by the action of bacteria in the absence of dissolved oxygen

3.4

baffle

a device used in a tank to check eddies and promote a more uniform flow through the tank

3.5

biochemical oxygen demand (BOD)

the amount of dissolved oxygen consumed by microbiological action when a sample is incubated, usually for 5 days at 20 °C

3.6

biological filter

a bed of relatively inert material (such as slag, moulded plastics, clinker, etc.) to promote or assist natural aerobic degradation of sewage

3.7

bottom water level (BWL)

the minimum operating water level in a pump well or dosing chamber

3.8

cesspool

a covered watertight tank used for receiving and storing sewage from premises which cannot be connected to a public sewer and where ground conditions prevent the use of a small sewage treatment works including a septic tank

3.9

combined system

a drainage system in which both foul and surface waters are conveyed in the same pipe

3.10

distributor

a device for spreading settled sewage over the surface of a biological filter

3.11

dosing chamber

a small tank which receives settled sewage until the desired quantity has accumulated, when it is discharged automatically to the distributor of a biological filter

3.12

dry weather flow (DWF)

when the sewage flow is mainly domestic in character, the average daily flow to the treatment works during seven consecutive days without rain (excluding a period which includes public or local holidays) following seven days during which the rainfall did not exceed 0.25 mm on any one day

NOTE With domestic sewage from industrial premises the dry weather flow should be based on the flows during five working days if production is limited to that period. Preferably, the flows during two periods in the year, one in the summer and one in the winter, should be averaged to obtain the average dry weather flow.

3.13**effluent polishing** (tertiary treatment)

a further stage of treating sewage by removing suspended solids. Consequential removal of residual BOD may occur

3.14**filter medium**

the material of which the biological filter is formed and on which a biological film containing bacteria and fungi develops

3.15**final effluent**

the effluent discharged from a sewage treatment plant

3.16**humus tank**

see secondary settlement tank

3.17**mixed liquor**

a mixture of sewage and activated sludge undergoing circulation and aeration in the aeration tank or channel of an activated sludge plant

3.18**mixed liquor suspended solids (MLSS)**

the concentration of dry solids in milligrams per litre of mixed liquor in the aeration tank or channel of an activated sludge plant

3.19**package plant**

a prefabricated factory-built sewage treatment installation

3.20**population equivalent**

the equivalent, in terms of a fixed population, of a varying or transient population, e.g. of a hospital or restaurant, based upon a figure of 0.060 kg BOD per head per day or 120 L per head per day

3.21**primary settlement tank**

a tank in which the majority of settleable solids are removed from the crude sewage flowing through it

3.22**rotary biological contactor**

a unit consisting of a series of closely spaced, parallel discs, mounted on a rotating shaft which is supported just above the surface of the waste water to be treated

3.23**scumboard**

a device used at the outlet end of a tank to retain scum and other floating material

3.24**secondary settlement tank**

a tank in which settleable solids or humus is separated from the effluent flowing through it from biological filters or an activated sludge plant

3.25**separate system**

a drainage system in which foul and surface water are conveyed by separate pipes

3.26**septic tank**

a type of settlement tank in which the sludge is retained for sufficient time for the organic matter to undergo anaerobic decomposition

3.27**sewage**

the water-borne wastes of a community

3.28**storm sewage**

sewage flowing to a treatment works in wet weather or discharged from storm overflows, when the sewage is diluted with rainwater

3.29**sludge**

a mixture of solids and water produced during the treatment of waste water

3.30**sludge loading**

the mass of BOD applied daily per unit mass of activated sludge MLSS

3.31**specific surface**

a property of biological filter media expressed as surface area per unit volume (m^2/m^3)

3.32**supernatant liquor**

the liquor in a settlement tank, lying between the deposited solids and any floating scum

3.33**suspended solids (SS)**

solids in suspension in sewage liquors as measured by filtration either through a glass fibre filter paper followed by washing and drying at 105 °C, or by centrifuging followed by washing and removal of the supernatant liquid

3.34**top water level (TWL)**

the maximum water level in a settlement tank, an aeration tank, or a sludge storage tank

3.35**water table**

the level below which the ground is saturated with water

4 Collection of information

The following main items of basic information should be obtained before designing small sewage treatment works:

- a) requirements of the local building control and planning authority;
- b) requirements of the appropriate water/river authority or its agent;
- c) minimum and maximum number of persons (resident and non-resident) to be served;
- d) average 24 h water consumption, and any special conditions affecting the composition of sewage and peak rates of flow; data are obtainable from the local water undertaking in many instances;
- e) existence of infiltration water;
- f) particulars of site;
 - 1) distance from nearest habitable building
 - 2) prevailing winds
 - 3) levels
 - 4) information as to the nature of the ground including the level and variations of the water table
 - 5) access for vehicles and plant
- g) particulars of outfall, e.g. tidal or inland waters, rivers, streams, ditches or soakage; also the proximity, highest known flood level and minimum flow of any stream or other watercourse to which discharge of the effluent is possible;
- h) conditions under which the works will normally operate and be maintained;
- i) possibility of the need for future extensions of the works or of their elimination by a comprehensive scheme;
- j) availability of electric power and mains water;
- k) facilities for eventual disposal of sludge and screenings.

Section 2. Materials**5 Notes on materials**

5.1 General. All materials used in the construction of any of the works described in this code should comply with the relevant British Standards.

Where no British Standard exists, materials should be suitable and adequate for the purpose for which they are used.

5.2 Aggregates for concrete. Aggregates should comply with the requirements of BS 882, BS 1201 or BS 1047. The nominal maximum size of coarse aggregate should be as large as possible within the limits specified in the appropriate British Standard, provided that the concrete can be satisfactorily placed and compacted. Where tests are required they should be carried out in accordance with BS 812.

5.3 Aggregates for mortar. The fine aggregates for mortar should consist of sand complying with the requirements of BS 1198, BS 1199 or BS 1200, or concreting sands in zones 3 and 4 from which the excess coarse materials in grading zones 1 and 2 of BS 882, BS 1201 have been removed.

5.4 Cement. Cement used for works included in this code should comply with the requirements of BS 12, BS 146, BS 915, BS 4027 or BS 4248¹⁾.

5.5 Cement mortar. Selection of the correct cement and aggregate for use in mortars should follow the recommendations of 5.3 and 5.4. A mortar mix having a 1 : 3 cement sand ratio is suitable for the following purposes:

- brickwork;
- jointing clay or concrete pipes where flexible joints cannot be used;
- rendering of inverts and benchings;
- bedding and haunching manhole covers and frames.

Calcium chloride should not be added to mortars.

5.6 Concrete

5.6.1 General. Concrete work should be in accordance with CP 110-1 and BS 5328, as well as with Building Research Establishment Digest No. 174 and other publications issued by the Building Research Establishment and by the Cement and Concrete Association. Reference should also be made to the National Water Council Civil Engineering Specification for the Water Industry.

¹⁾ It should be noted that supersulphated cement made to BS 4248 is no longer manufactured in the United Kingdom although it can be imported if it is required in relatively large quantities.

5.6.2 Admixtures. Admixtures for promoting workability, for improving strength, for entraining air or for any other purpose should be used only with the prior approval of the client or his representative.

Calcium chloride as an admixture should not be used in reinforced concrete, prestressed concrete or any concrete made from sulphate-resisting Portland cement. For guidance, reference should be made to CP 110.

5.6.3 Workmanship. Concrete should be mixed in a mechanical mixer until there is a uniform distribution of the materials and the mix is uniform in colour. It should be transported to the point of placing as rapidly as practicable by methods that will prevent segregation or the loss of any of the ingredients, placed as soon as possible and thoroughly compacted by rodding, tamping or vibration so as to form a void-free mass around any reinforcement and into the corners of the formwork or excavation. Exposed concrete should be cured by keeping it in a damp condition for at least four days. Concreting should not be carried out when the ambient temperature is below freezing point or when a falling temperature of 4 °C is indicated.

If concreting has to be carried out at or near freezing point, precautions should be taken to ensure that the concrete when placed has a temperature of at least 5 °C and is maintained above 5 °C until it has thoroughly hardened. When necessary, the finished concrete should be insulated and protected after placing. Frozen materials, or materials containing ice should not be used.

5.7 Glass fibre reinforced cement (GRC). Tanks of GRC for use for small septic tanks and cesspools are under development; reference should be made to Building Research Establishment Digest No. 216 on the suitability of this material where its use is proposed.

5.8 Glass fibre reinforced plastics (GRP). The structural performance and durability of tanks constructed of GRP is dependent upon the quality of the resin, the glass fibre reinforcement and the conditions and workmanship involved in the laying-up and curing of the finished product. GRP has a lower modulus of elasticity relative to its tensile or compressive strength in comparison to steel, so it is essential that care be taken in the design to limit strain to acceptable levels; liaison with the manufacturer and close supervision on site are therefore strongly recommended, and the requirements of BS 4994 should be followed.

5.9 Steel tanks. Pressed steel tanks complying with BS 1564 may be used, but should be adequately protected, both on the inside and the outside, against corrosion.

5.10 Clay and concrete pipes and fittings. All clay and concrete pipes and fittings should comply with the relevant British Standards, and wherever practicable should have flexible joints.

Section 3. Design

6 Design: general

6.1 Climatic considerations. Design factors in this code are for average UK temperate conditions only and the performance of treatment units will vary with changes in temperature, exposure and altitude. Design factors recommended should not therefore be adopted for use in non-temperate climates or in temperate climates with extremes of conditions without special consideration. The operation of works is also affected by the prevailing weather. For example, the desludging of tanks may have to be carried out more frequently in hot conditions, and during periods of frost, filters and mechanical plant may be affected by freezing.

6.2 General design considerations

6.2.1 Installation. Sewage treatment works provide for the settlement and retention of solids and usually include biological treatment carried out by the use of biological filters or activated sludge, or for the biological treatment of raw sewage followed by separation of solids. Before any process or combination of processes is used, the required standard of effluent²⁾ should be ascertained from the water/river authority.

Cesspools are provided to receive and retain crude sewage and form no part of sewage treatment (see clause 8).

A septic tank installation provides only partial treatment of sewage but is permissible without undue risk of pollution in some locations. Biological treatment to follow primary settlement may be necessary and, in some cases, a further polishing stage is required (see clause 14).

The design criteria given in this code relate specifically to foul drainage flows and surface water and subsoil water should be excluded from works designed in accordance with the code. Where this is not possible, i.e. with partially separate or combined systems, specialist design advice should be sought.

²⁾ For example, normal requirements are 30 mg/L max. suspended solids and 20 mg/L max. BOD (described as "30 : 20")

It is emphasized that a multiplicity of small sewage treatment works in a limited area, particularly for single houses, is undesirable. Greater efficiency of operation as well as economy of construction can be achieved by collective drainage and treatment arrangements. Consideration should first be given to the possibility of providing such a scheme as a preferable alternative to several individual works.

In choosing the type of treatment, the designer should compare the costs of maintenance and operation as well as the initial capital cost of the works. For example, the availability and type of labour should be investigated and the cost of electricity and fuel in operating treatment units, pumps or other plant should be considered. With regard to capital costs, the cost of different types of filter media and the probable life of the various materials of construction are relevant.

The designer should make adequate provision, where appropriate, for unusual pollution loads. These may arise from the use of waste disposal units and from the specialized occupancy of premises (e.g. public houses, industrial premises), or from high flows from establishments such as hospitals, institutions and hotels. Domestic use of detergents and disinfectants is not detrimental but excessive use may have a harmful effect on the performance of the works.

Rags and floating debris are always a problem in sewage treatment works, causing blockages and fouling mechanical plant. Prior removal from the incoming flow is advisable.

Excessive quantities of grease and oil may cause malfunction of a small sewage works. In such cases, arrangements should be made where practicable for grease and oil to be removed at source or for them to be excluded from the sewerage system.

Sludge is continuously produced in the settlement tanks and needs to be removed at frequent intervals. The disposal of the liquid sludge usually accounts for 40 % of the works operating costs. Drying beds on site are an option but can give rise to odour and insect nuisance and pose problems regarding clearance. The cost of removal by tanker, ideally to a larger works for treatment, or to agricultural land, is dependent upon distance travelled, but is likely to be comparable in overall cost to drying beds and less problematical.

Measurement of flows on small works is difficult. Nevertheless, where practicable this should be done. To minimize blockages it is more satisfactory to measure flow of the final effluent. Where continuous measurement is not installed a facility such as a V-notch weir should be provided to permit the use of portable measuring equipment when required. Portable tipping troughs with recording meters attached have proved to be satisfactory.

6.2.2 Location and safety

6.2.2.1 Siting. Sewage treatment works should be as far from habitable buildings as is economically practicable. The direction of the prevailing wind should be considered in relation to any properties when siting the works. A small treatment works serving more than one premises incorporating conventional biological treatment should be a minimum of 25 m from any dwelling and this should be progressively increased for larger treatment works.

For works where noise is a factor, e.g. extended aeration installations, it is difficult to be specific on the distance from dwellings that will avoid nuisance from noise, as different circumstances, including the relative sizes of plant, merit individual consideration. Compressors mounted directly over tanks produce much more noise, because of reflection and vibration, than they would if located on the ground. Special provisions to reduce noise include placing compressors under cover and surrounding installations with earth banks or close-boarded fences.

Good road access should be provided to enable the tank-emptying vehicle to operate within its suction-lift capability. Wherever possible, pumping should be avoided by locating the plant lower than the premises to be served. If pumping is inevitable it is preferable to use settled sewage rather than crude sewage. Treatment units should not be located in an area subject to flooding or where the water table can rise to such levels as to cause flow into the treatment units.

6.2.2.2 Safety. Safety should be given full consideration in the design of sewage treatment works. They should be adequately fenced against unauthorized interference to prevent potential accidents.

Attention is drawn to the provisions of the Health and Safety at Work etc. Act 1974, and to the advice given in Health and Safety Guideline No. 2 "Safe working in sewers and at sewage works" and other publications of the National Joint Health and Safety Committee for the Water Service.³⁾

³⁾ Available from Information Services Division, National Water Council, 1 Queen Anne's Gate, London SW1H 9BT.

6.3 Types of installation (see Figure 1). The following types of installation, or combinations of them, are covered in the clauses referred to below.

Cesspools (see clause 8).

Septic tanks (see clause 9 and Figure 2, Figure 3, Figure 4, Figure 5, Figure 6 and Figure 7).

Preliminary treatment: removal of rags and debris (see clause 10).

Settlement tanks (see clause 11) and Figure 8 and Figure 9).

Biological filters, including contactors (see clause 12 and Figure 10 and Figure 11).

Activated sludge units and secondary settlement tanks (see clause 13).

Tertiary treatment (polishing) processes (see clause 14)

grass plots (Figure 12)

clarifiers (Figure 13)

lagoons.

7 General requirements for tanks

It is essential that tanks constructed to hold or treat sewage, e.g. cesspools, septic tanks, primary and secondary settlement tanks and chambers, should be of watertight construction so that they permit neither ingress of ground water nor egress of sewage to the ground.

Engineering bricks, concrete bricks, in situ concrete and large precast concrete pipes are all used for the construction of tanks, also units prefabricated from steel and plastics materials, including glass reinforced plastics. Brickwork should normally be in cement mortar and of not less than 229 mm nominal thickness. In situ concrete for walls, floors and surrounds should be not less than 150 mm thick and of C/25/P mix (see clause 4 of BS 5328). Plastics materials should be to an appropriate specification.

Where construction in waterlogged ground is unavoidable, provision should be made for the prevention of tank flotation during construction, emptying and maintenance.

A roof should always be provided to a cesspool for safety purposes, to prevent nuisance and to preclude entry of surface water and rainwater. The tank roof should have structural strength adequate for the location of the tank. Access, with cover, should be provided in the roof for emptying, cleansing and maintenance. Where entry is likely to be required, at least two access openings should be provided. Similarly, a roof should be provided to a septic tank, in which case it may be wholly or partially removable and be of concrete or timber. If fixed, the roof should have adequate access openings, with covers, including those necessary for inspection and cleansing of the inlet and outlet arrangements. Where it is not roofed a septic tank should be provided with a protective fence to prevent unauthorized access. Materials should be adequately protected against corrosion and electrolytic attack where appropriate.

Cesspools and septic tanks should be adequately ventilated and access to rod the horizontal inlet pipe should be provided. An integral inspection chamber can be provided.

8 Cesspools

8.1 General

8.1.1 It is essential that cesspools are, and remain, impervious to ingress of ground- or surface-water and to leakage.

8.1.2 Before deciding to provide a cesspool, the available local facilities for continual emptying should be carefully ascertained and whether such a service will be provided by public authority or private contractor. The cost of emptying by tanker vehicles may be high, and it should be noted that an average household of three persons will produce 7 m³ (the capacity of a typical tanker) in about 3 weeks, necessitating some 17 journeys per annum. Each journey may involve the haulage of 7 t of material a distance of several miles.

8.1.3 The relevant sections of current legislation are set out in Appendix B. The Building Standards (Scotland) Regulations do not recognize the provision of cesspools as a means of dealing with foul drainage.

8.1.4 The responsibility for ensuring that new or existing buildings have a proper means of drainage rests with the local authority whose approval is to be obtained.

8.2 Locations

8.2.1 The site selected for a cesspool should not be so near to any inhabited building as to be liable to become a source of nuisance or a danger to health (a minimum of 15 m is desirable) and it is essential that no well, stream, river, spring or aquifer likely to be used for drinking or domestic or amenity purposes is liable to be polluted.

8.2.2 The site of the cesspool should preferably be on ground sloping away from and sited lower than any existing building in the immediate vicinity.

8.2.3 Consideration should also be given to the direction of the prevailing wind.

8.2.4 Adequate means of vehicular access should be provided to within 30 m of the cesspool.

8.2.5 The possibility of connection to a public sewer in the future should be borne in mind as a factor in the siting of a cesspool.

8.3 Capacity

8.3.1 Normally the capacity required will limit the choice of a cesspool as a means of disposal to single houses or buildings within the same curtilage, the total population of which does not exceed about eight people.

8.3.2 Constructional considerations will probably limit the economic capacity of a single tank cesspool to a maximum of about 50 m³. It should be noted that the Building Regulations prescribe a minimum of 18 m³.

8.3.3 As a general rule a capacity of not less than 45 days' storage should be allowed⁴⁾.

8.3.4 The drainage should be on the totally separate system, and every precaution should be taken to ensure that there is no entry of surface or subsoil water into the foul drains.

8.4 Arrangement. The most satisfactory shape for a cesspool is cylindrical with the diameter equal to the length/depth, but it may be square or rectangular in plan to suit the conditions of the site. The depth from the cover of the access opening to the floor of the tank should not normally exceed 4 m on a flat site and may need to be further restricted on a sloping site to limit the suction lift when emptying.

8.5 Drain connection. The inlet drain should be provided with access appropriate for the drainage system and should terminate with the pipe projecting about 75 mm clear of the inside of the wall of the cesspool.

8.6 Ventilation. Stored sewage in a cesspool becomes extremely foul, and particular attention should therefore be paid to ventilation, which is normally through the ventilation pipe on the house drainage system.

A separate fresh air inlet of not less than 100 mm diameter incorporating a suitable non-return flap should be provided, its point of entry into the cesspool being as high as possible beneath the cover. This should have a suitable head or grating about 800 mm above ground level and well clear of the cesspool cover. Attention should be paid to the maintenance of the flap.

8.7 Entry into confined spaces. The access should not be less than 600 mm clear opening to enable inspection, maintenance or removal of consolidated sludge to be carried out. Entry into the cesspool chamber may be necessary. The chamber should be made as safe a place of work as possible and safe methods of working should be adopted (see 6.2.2.2).

8.8 Abandonment. When a cesspool is to be abandoned, it is essential that it be left in a condition that is neither dangerous nor prejudicial to health. This normally entails removal of the remaining contents and backfilling of the chamber with hardcore or similar stable non-compressible material, demolition of the structure within 500 mm of ground level, and reinstatement of the ground surface.

9 Septic tanks

9.1 Capacity. Calculation of the total capacity of septic tanks for the populations covered by this code should be made on the basis of the number of persons to be served, and the following formula is recommended for general use, where desludging is carried out at not more than 12-monthly intervals:

$$C = (180P + 2000)$$

where

C is the capacity of the tank (in L) with a minimum value of 2 720 L; and

P is the design population (see clause 4) with a minimum value of 4.

This formula allows for proportionately larger retention at the lower populations in order to cover the surges in flow which are experienced in small systems.

⁴⁾ Effective storage time will depend on the population served, the water consumption and whether there is any infiltration into the foul drains, but in general a minimum of 150 L per head per day should be a reasonable provision for average circumstances.

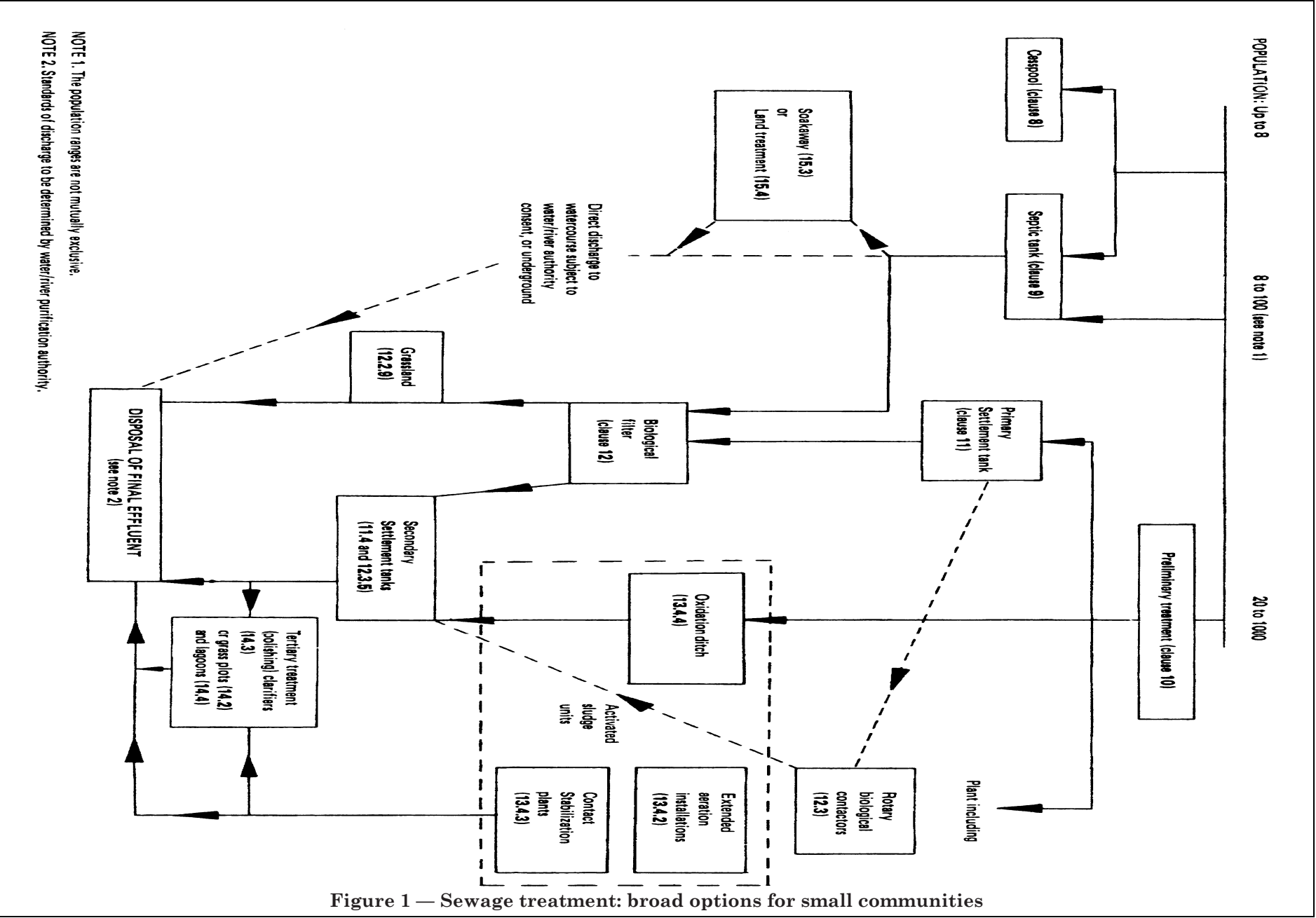


Figure 1 — Sewage treatment: broad options for small communities

For schools, similar premises and hotels, capacity requirements can be evaluated separately or included in the general formula using population equivalent (see 3.20) figures for P after taking into account factors such as part-time occupancy and shared cooking facilities; for example, in appropriate circumstances allowance might be made in the factor P on the basis of two part-time occupants being equivalent to one full-time occupant. Specialist advice is necessary for plants treating abnormal flows or non-domestic sewage.

Where waste disposal units are installed, additional sludge solids are discharged with the sewage and the capacity of septic tanks should be increased by 70 L for each person served.

Where multi-compartment tanks are used, the inlet (settlement) zone should have a capacity of not less than $2/3 C$ and the subsequent zones should have a combined capacity of not less than $1/3 C$.

The calculated capacity C is recommended as a minimum for all types of septic tanks and the figure of 180 in the formula may be regarded as made up as follows.

	L
Sludge storage capacity	90
Balance to cover	
a) 12 h storage of average domestic water usage of 120 L per head per day assumed as passing to drains	60
b) higher consumptions and/or infiltration etc.	30
	180

NOTE 120 L per head per day is quoted in NWC publication "The Water Industry in Figures" October 1980.

Capacities may, however, be increased to take account of particular circumstances (use of high consumption fittings, projected growth in water usage, reliable information on infiltration, etc.).

9.2 Arrangement. The design of septic tanks should be such that the discharge of solids in the tank effluent is kept to a minimum. This is best achieved by the use of tanks in series.

For rectangular tanks two in series should be used, either by constructing two separate tanks or by dividing a single tank into two by a partition. In either case the compartments should be not less than 1 200 mm deep below TWL for up to 10 persons and not less than 1 500 mm deep below TWL for larger populations. The first compartment should have a length of not less than twice its width. In the larger installations serving over 30 persons, a baffle should be provided at the inlet and a scumboard at the outlet. In order to facilitate desludging operations, the floor of the first compartment should have a fall of 1 : 4 towards the inlet end.

Typical arrangements for installations using two separate tanks are shown diagrammatically in Figure 2 (for populations of up to 30) and Figure 3 (for populations of over 30). Where the two compartments are separated by a dividing partition as in Figure 4 (up to 30 persons) and Figure 5 (over 30 persons), connection between the compartments should be made either as orifices arranged horizontally or as vertical slits at each side of the partition (Figure 4) and not by the use of a dip and communicating pipe (see 9.3).

For populations of over 60, duplicate tanks, each of half the total calculated capacity required, should be provided and operated in parallel; this arrangement permits all the flow to be passed through one unit while the other is being desludged. To enable the top water to be decanted when desludging, a decanting valve should be provided in the wall dividing the two tanks; the invert of this valve should be 625 mm below TWL. Each tank should comprise two compartments but, where the installation is for more than about 100 persons and surge flows cause less disturbance, consideration should be given to the use of two single-compartment tanks in parallel.

Except where emptying and desludging will be carried out only by a tank emptying vehicle, tanks should be provided with a valve-controlled sludge pipe not less than 100 mm in diameter at their lower end, arranged so as to discharge to a sludge drying bed or beds. Positioning the sludge pipe slightly above the floor level of the tank will facilitate the retention of a proportion of the sludge for reseedling purposes.

This code does not preclude the use of prefabricated materials, e.g. concrete and glass fibre reinforced cement or plastics, and the guidance given previously on the proportioning of multi-compartment tanks may be difficult to apply directly to non-rectangular tanks made from such materials. The inherent principles are nonetheless commended and should be followed where reasonably practicable. Some adjustment to volume may be necessary to achieve this.

9.3 Inlets and outlets. The design of septic tank inlets and outlets should be such as to introduce the crude sewage and to remove the clarified liquid with the least possible disturbance of the settled sludge or the surface scum.

A satisfactory form of inlet for rectangular tanks not more than 1 200 mm wide is a T-shaped dip pipe of cast iron or other suitable material not less than the nominal bore of the incoming drain, fixed inside the tank, with the top limb rising above scum level and the bottom limb extending about 450 mm below TWL.