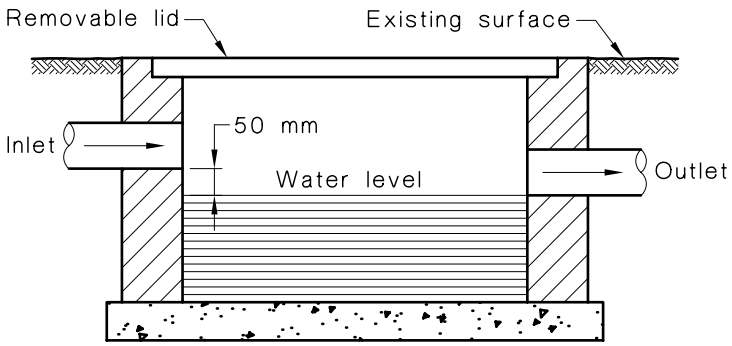


millimetres

Nominal size of outlet DN	Minimum internal dimensions			
	Rectangular		Circular	Depth below invert of outlet
	Width	Length	Diameter	
≤ 150	600	1 000	1000	450
225	700	1 000	1000	450
300	800	1 000	1000	450
375	1 000	1 200	1200	550

FIGURE 8.2 MINIMUM INTERNAL DIMENSIONS FOR SILT ARRESTERS

8.6.3 Falls across pits The positions of inlet and outlet pipes for pits in site stormwater drains shall be selected to minimize head losses, and to facilitate the flushing of sediment from pits. The following requirements shall be followed:

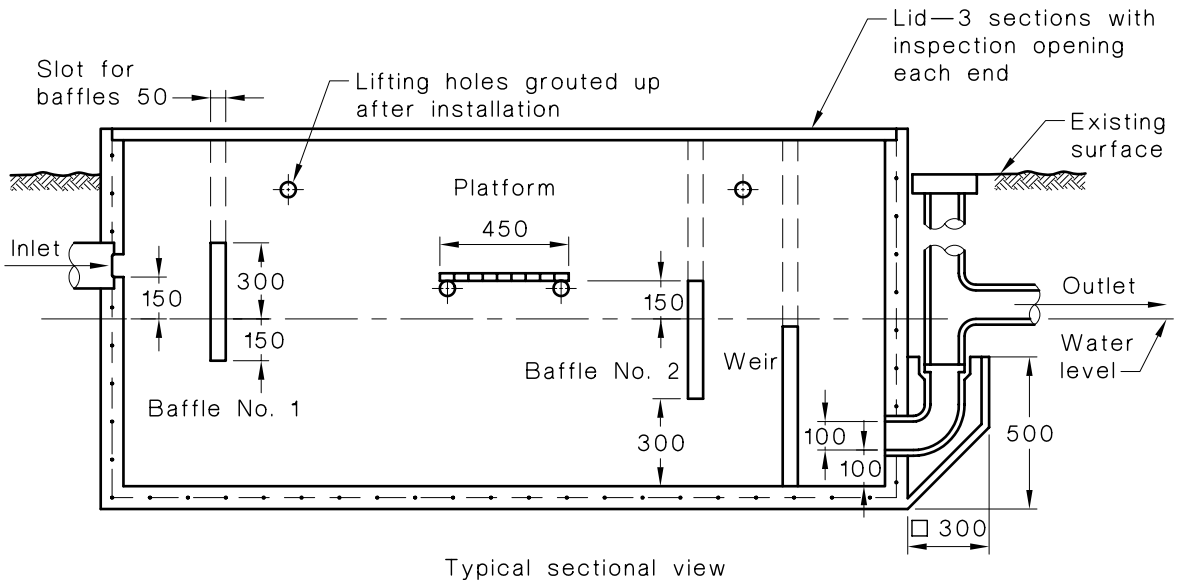
(a) Where possible, inlet pipes shall be pointed directly at the pit outlet, to assist the passage of flow and reduce turbulence.

(b) Pits without a sump, as shown in Figure 8.4(a), shall have the floor graded to fall at least 20 mm between the inverts of the inlet and outlet pipes. Sump pits shall have a flat floor, but a fall of at least 20 mm between pipe inverts, as shown in Figure 8.4(b).

8.6.4 Inlets Gratings or slotted kerb inlets of sufficient size to admit the flows shall be provided, as specified in Clause 5.5.9. Where pits act as surcharge outlets, the provisions of Clause 5.5.11 shall apply.

For concrete paved areas care should be taken that construction or expansion joints do not coincide with the lines of collecting channels and do not cross areas in which ponding occurs at sag inlets. Gratings shall be set 5 mm below the levels of surrounding paved areas to allow for settlement after construction.

Frames of gratings or inspection covers on pits in areas subject to vehicular traffic shall be bedded using good quality mortar with low-water content on well-built masonry or concrete walls. Sufficient time shall be allowed for the bedding to develop its strength before a grating or cover is subjected to traffic.

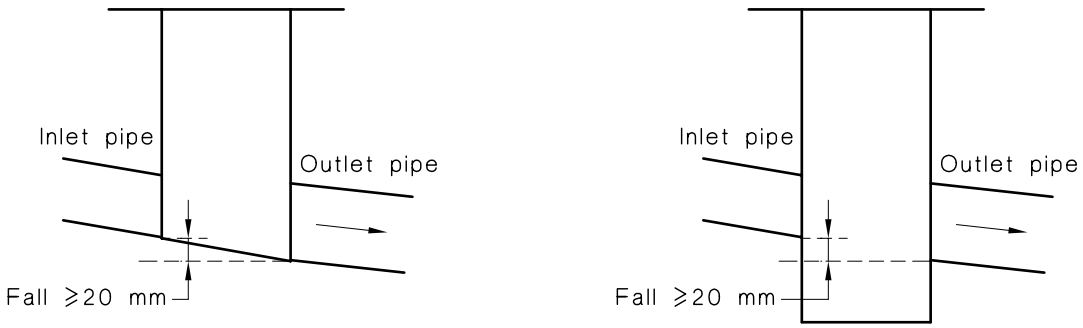


Typical sectional view

millimetres

Maximum hourly discharge	Minimum internal dimensions			Minimum spacing of baffles and weir			
L	Width	Length	Depth below crest of weir	Inlet to baffle No. 1	Baffle No. 1 to baffle No. 2	Baffle No. 2 to weir	Weir to outlet
500	600	1 870	700	200	1 200	150	200
750	600	1 870	1 000	200	1 200	150	200
1 000	700	2 660	600	300	1 640	300	300
1 500	700	3 020	600	300	2 000	300	300
2 000	1 000	3 020	780	300	2 000	300	300
3 000	1 250	3 820	1 050	300	2 500	300	600
4 000	1 350	4 020	1 150	300	2 700	300	600
5 000	1 450	4 020	1 250	300	2 900	300	600

FIGURE 8.3 TYPICAL MINIMUM DIMENSIONS FOR GENERAL PURPOSE (OIL OR SILT OR BOTH) ARRESTERS



(a) Pit without sump

(b) Sump pit

FIGURE 8.4 PIT ARRANGEMENTS

8.6.5 Materials and construction

8.6.5.1 *Rectangular or square pits and arresters* Rectangular or square stormwater pits and inlet pits and all arresters shall either be—

(a) constructed in situ on a concrete bed with at least the same external dimensions as the pit or arrester and at least 150 mm thick with walls of—

(i) brickwork for wall depths, measured from the existing surface to the invert of the outlet, that—

(A) do not exceed 600 mm, at least 110 mm thick; or

(B) exceed 600 mm but not 1500 mm, at least 230 mm thick.

(ii) non-reinforced concrete with thickness not less than that determined from Figure 8.5; or

(iii) reinforced concrete with thickness and reinforcement determined by a professional engineer; or

(b) precast or prefabricated in accordance with Clause 2.12.8.

8.6.5.2 *Circular pits* Circular stormwater pits and inlet pits shall be pre-cast or prefabricated in accordance with Clause 2.12.8.

8.6.5.3 *Conduits and channels* The conduits and channels in pits shall be constructed in accordance with the following:

(a) The fall from the invert of each inlet to the invert of the outlet shall not be less than the values given in Figure 8.4.

(b) For pits located inside buildings, flows shall be conveyed through the pit by—

(i) a fully enclosed conduit with sealed inspection openings; or

(ii) a graded floor, with the pit fitted with an airtight cover.

(c) For pits located outside buildings, flows shall be conveyed through the pit—

(i) as specified for Item (b)(i); or

(ii) by a graded floor or sump.

8.6.5.4 *Ladders* Rung and individual-rung ladders installed in pits and arresters shall comply with AS 4198 and AS 1657, respectively.

Following manufacture, steel ladders shall be hot dip zinc galvanized as specified in AS 1650.

8.6.5.5 *Cement rendering* Brick walls and floors of pits and arresters shall be rendered with a coat of cement mortar at least 10 mm thick, trowelled to a smooth finish.

8.6.5.6 *Upper walls of stormwater pits* The upper walls of stormwater pits shall be—

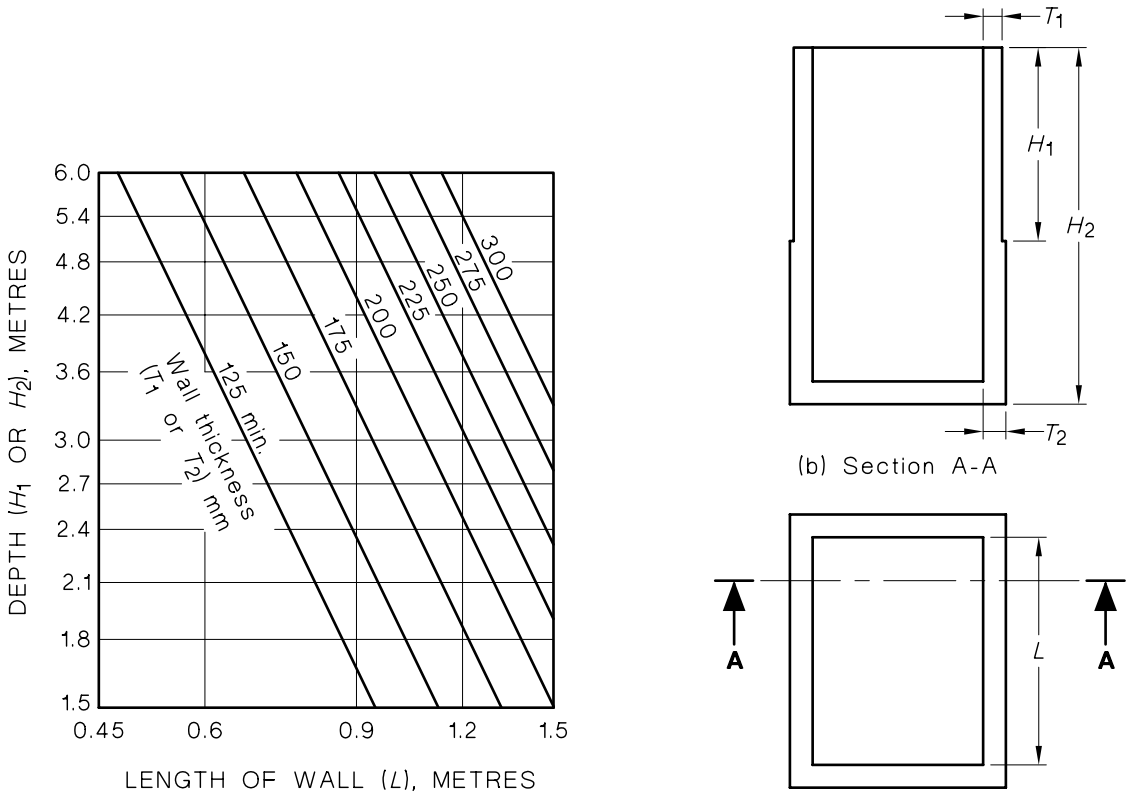
(a) vertical; or

(b) tapered upwards to the access shaft from a point not less than—

(i) 1500 mm above the invert of the outlet pipe; and

(ii) 100 mm above the top of the highest inlet pipe.

The diameter of the access shaft shall not be less than 600 mm, and its length shall not be greater than 350 mm.



(a) Value of wall thickness T_1 or T_2

(b) Section A-A

(c) Plan

Example:
For a non-reinforced concrete wall of length (L) = 1.2 m, and maximum depths of 1.8 m (H_1) and 2.4 m (H_2) the thicknesses are 175 mm (T_1) and 200 mm (T_2), respectively.

NOTE: Thickness T_2 obtained from the graph applies to the thickness of the bottom section, and T_1 to the top section.

FIGURE 8.5 MINIMUM THICKNESS OF NON-REINFORCED CONCRETE WALLS FOR PITS AND SILT ARRESTERS

8.6.5.7 *Access openings* For stormwater pits which are not intended to act as inlets for stormwater and for arresters, circular or rectangular access openings shall be fitted at finished surfaces with removable covers with a clear opening of not less than 500 mm.

8.6.5.8 *Construction joints* Construction joints shall be made in accordance with the following:

(a) Not more than 24 h shall elapse between successive pours of concrete.

(b) The keying surface shall be scabbled and cleaned.

(c) A thick cement slurry shall be applied immediately prior to pouring concrete.

8.6.5.9 *Inserts* Holes broken in or formed in walls of pits and arresters for insertion of pipes or fittings shall be made watertight by—

(a) keying and preparing as for construction joints and caulking the annular space between the concrete and pipe or fitting with a stiff mortar (see Clause 2.9.5); or

(b) sealing with an epoxy-based or other sealant authorized by the network utility operator.

8.6.5.10 *Connections* Connections to pits and arrestors shall comply with Clause 7.3.3.

8.7 SURCHARGE OUTLETS Surcharge outlets shall comply with Clause 5.5.11.

8.8 JUNCTIONS

8.8.1 General Junctions in site stormwater drains shall be made by means of—

(a) an oblique junction or sweep junction at an upstream angle of not greater than 60°, as shown in Figure 8.6, and preferably less than 45°;

(b) an opening cut into a site stormwater drain in accordance with Figure 8.7 for nominal pipe sizes equal to or greater than DN 375; or

(c) a pit.

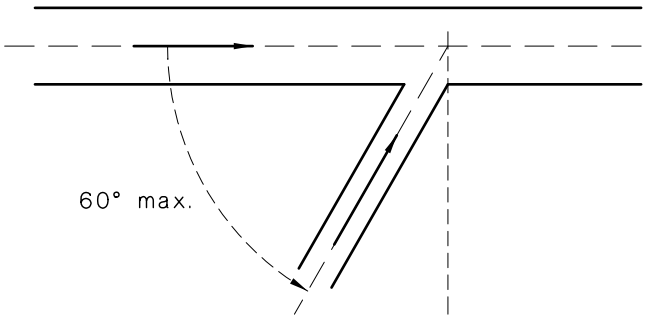
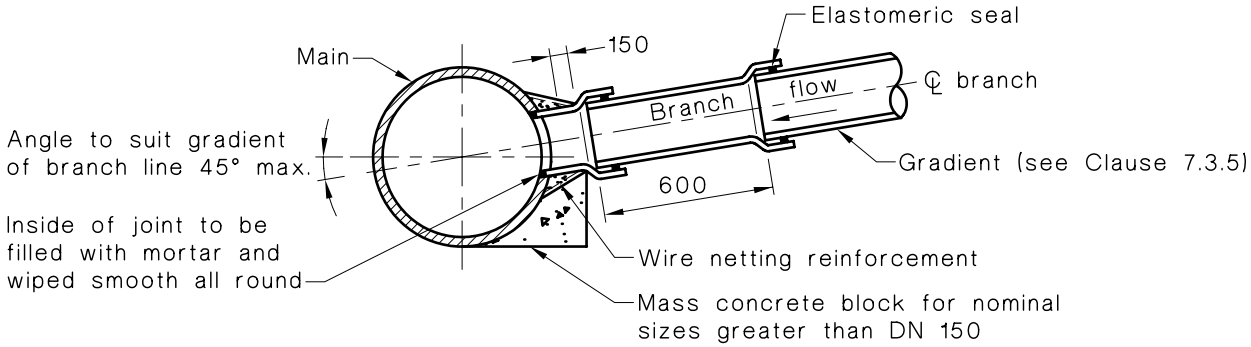


FIGURE 8.6 ALLOWABLE OBLIQUE OR SWEEP JUNCTION CONNECTION



NOTES:

1 The centre-line of each branch shall intersect the centre-line of the main line.

2 The change of direction of flow at a cut-in shall be between 45° and 90°, as shown in Figure 8.8.

FIGURE 8.7 CUT-IN CONNECTION FOR SITE STORMWATER DRAINS EQUAL TO OR GREATER THAN DN 375

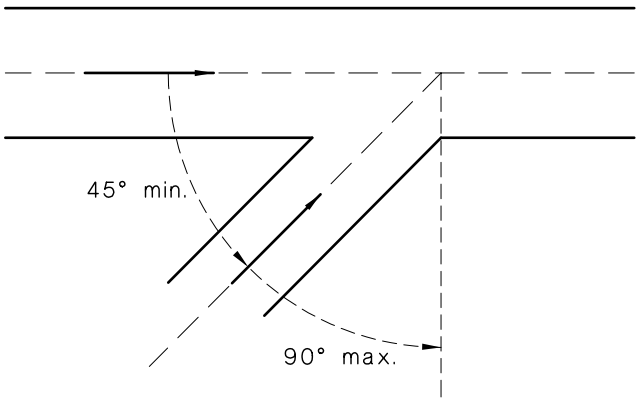


FIGURE 8.8 ALLOWABLE CHANGE OF DIRECTION OF FLOW AT A BRANCH CONNECTION OR CUT-IN

8.8.2 Square junctions For site stormwater drains square junctions shall only be used—

(a) at the top of a jump-up at a point of connection;

(b) as an inspection opening; or

(c) at the top of a jump-up in the site stormwater drain in lieu of a bend and inspection opening.

8.9 JUMP-UPS Jump-ups in site stormwater drains shall be constructed in accordance with the following:

(a) The bend at the base of the jump-up shall be supported on a concrete footing of a thickness not less than 100 mm and extending upwards not less than 100 mm.

(b) Either a bend incorporating a full-size inspection opening or a junction fitting shall be used at the top of the jump-up (see Figure 8.9).

(c) Branch site stormwater drains shall connect to the shaft of a jump-up using junction fittings shown in Figure 8.9 and shall be fully supported.

(d) The jump-up shall be protected and supported during installation and placement of trench fill.

8.10 ANCHOR BLOCKS Where the gradient of a site stormwater drain exceeds 1:5, anchor blocks shall be installed—

(a) at the bend or junction at the top and bottom of the inclined site stormwater drain (see Figure 8.10); and

(b) at intervals not exceeding 3 m.

Anchor blocks for such drains shall be of reinforced concrete—

(i) with a thickness of not less than 150 mm;

(ii) with steel reinforcement for such drains of nominal sizes—

(A) DN 100 or DN 150, two bars of not less than 10 mm diameter bent to a radius of about 200 mm or 250 mm, respectively and placed as shown in Figure 8.10.

(B) greater than DN 150, shall be designed by a suitably qualified competent person;

(iii) which extends—

(A) across the full width and is firmly keyed into the sides of the trench;

(B) above the top of such drain by not less than 150 mm; and

(C) below the foundation of the trench by not less than 150 mm; and

(iv) which does not cover any flexible joint.

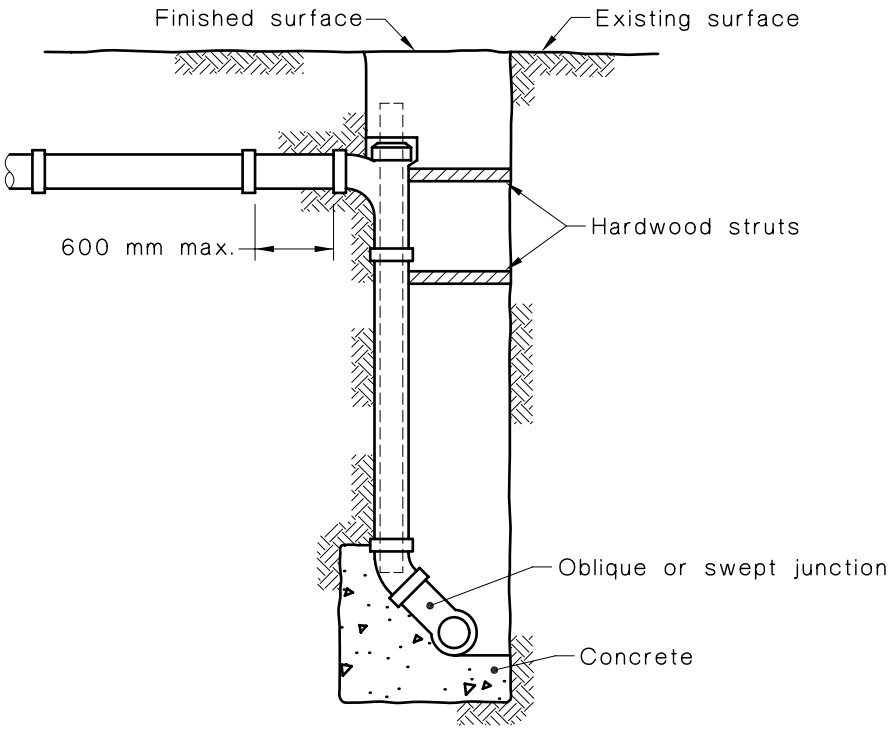


FIGURE 8.9 VERTICAL JUMP-UP TO BRANCH SITE STORMWATER DRAIN

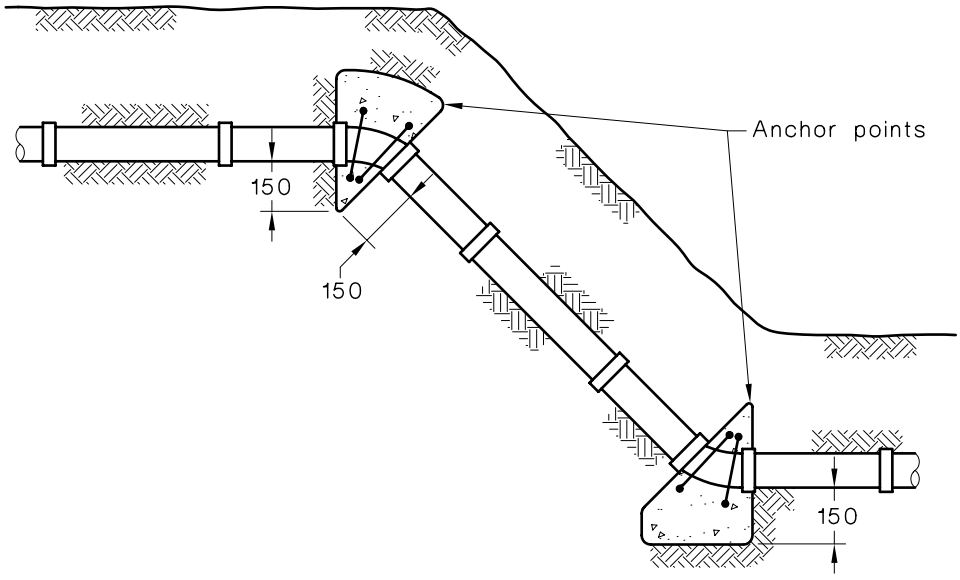


FIGURE 8.10 ANCHORING OF SITE STORMWATER DRAINS

8.11 ON-SITE STORMWATER DETENTION (OSD) SYSTEMS

8.11.1 General requirements OSD systems, located both above and below ground, shall comply with the following:

(a) Provision shall be made for the harmless escape of overflows in the event that an outlet blocks and the storage completely fills. Any ponding of water resulting from a blockage shall occur at a visible location, so that the fault can be noticed and corrected.

(b) Ponding and overflow levels shall be not less than 300 mm below any adjacent habitable floor levels of buildings and not less than 150 mm below non-habitable floor levels.

8.11.2 Above-ground systems For OSD systems located above the ground, the following requirements are recommended:

(a) In landscaped areas—

(i) a desirable minimum slope for surfaces draining to an outlet is 1:60, and an absolute minimum slope is 1:100;

(ii) the desirable maximum depth of ponding under design conditions is 300 mm;

(iii) required storage volumes in landscaping areas be increased by 20% to allow for vegetation growth, construction inaccuracies and possible filling;

(iv) subsoil drains be provided around outlets to prevent the ground becoming saturated during prolonged wet weather; and

(v) where the storage is located in areas where frequent ponding could cause maintenance problems or inconvenience, the first 10% to 20% of the storage required be in an area which can tolerate frequent inundation, such as a paved outdoor entertainment area, a small underground tank, a permanent water feature, or a rockery.

(b) In driveway and car-park storages—

(i) depths of ponding not exceed 200 mm under design conditions;

(ii) transverse paving slopes within storages be not less than 1:140; and

(iii) where the storage is located in commonly-used areas where ponding would cause inconvenience, part the storage required be provided in an area or form which will not cause a nuisance.

NOTE: The appropriate proportion of the storage will depend on the local rainfall climate, but 15% would be an indicative value. As a further guide, ponding outside this area should only occur approximately once every year, on average.

8.11.3 Below ground systems OSD systems located in underground tanks shall comply with the following:

(a) The hydraulic control for the storage, usually an orifice plate on an outlet pipe, shall be firmly fixed in place to prevent removal or tampering. (A suitable plate may be of 3 to 5 mm thick stainless steel with a circular hole of the diameter required by the designer machined to 0.5 mm accuracy. The machined hole is to retain a sharp edge.) The orifice diameter shall not be less than 25 mm.

(b) For tanks with open storage zones, allowance shall be made for the accumulation of debris and sediment in the storage, as follows:

(i) Floors of tanks shall be graded at a minimum slope of 1:140 towards the outlet, to minimize ponding and depositing of debris.

(ii) An inspection/access opening shall be provided above the location of the outlet with dimensions at least 600 mm × 600 mm or 600 mm diameter for storages up to 800 mm deep and 600 mm × 900 mm for deeper storages. There shall be no impediments to the removal of debris through this opening. Inspection shall be possible without residents or owners having to remove heavy access covers.

(iii) When storages are not sufficiently deep to work in (i.e. less than 1.5 m deep), access shall be provided at intervals of approximately 10 m to allow the system to be flushed to the storage outlet. Adequate access shall be provided at the outlet.

(iv) A sump (with a base level set below that of the main storage) shall be provided at the outlet point, set below the level of the main storage to collect debris. Where a special discharge control pit is included in the storage, this shall contain a sump set a minimum of 1.5 times the diameter of the orifice of the outlet below the centre of the orifice. Sumps shall be provided with adequate weepholes to drain out to the surrounding soil, and shall be founded on a compacted granular base.

(c) Where the depth of the tank exceeds 1.2 m, a ladder in accordance with Clause 8.6.6.2 shall be installed.

(d) Below ground OSD systems shall comply with AS 2865.

It is recommended that underground tanks comply with the following:

(a) Screens with the following characteristics be provided to cover each orifice outlet:

(i) For orifices up to 150 mm diameter, a fine aperture-expanded metal mesh screen (BHP Maximesh Rh3030 or equivalent) with a minimum area of 50 times the area of the orifice. For larger diameter orifices, a coarser grid mesh with a minimum area of 20 times the orifice area may be used as an alternative.

(ii) Steel screens be of stainless steel or hot-dipped galvanized.

(iii) Where aperture-expanded mesh screens are employed, they be positioned so that the oval-shaped holes are horizontal, with the protruding lip angled upwards and facing downstream. A handle may be fitted to ensure correct orientation and easy removal for maintenance.

(iv) Screens be located so that they are at least 1.5 times the orifice diameter or 200 mm from the orifice plate, whichever is the greater.

(v) Screens be placed no flatter than 45° to the horizontal in shallow storages up to 600 mm deep. In deeper or more remote locations, the minimum angle should be 60° to the horizontal.

(b) If the storage is sealed, a vent be provided to expel any noxious gases.

(c) The storage be designed to fill without causing overflows in upstream conduits due to backwater effects.

NOTE: A system may provide a cellular storage volume rather than an open void, and some may permit infiltration to the surrounding soil.

8.11.4 Materials Storages shall be constructed of concrete, masonry, aluminium/zinc alloy-coated steel, zinc-coated steel, galvanized iron or plastics.