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Water butts as sustainable (urban) drainage systems (SuDS) devices

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http://hdl.handle.net/10026.1/14689

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Appendices

Appendix A – Outlet concepts

Concept A: Simple Outlet

Overview: Concept is simple. Potential for flow restriction is available through orifice inserts of varying diameter. Discharge commences as soon as water rises above orifice opening.

Advantages: Simple concept – low cost and is easy to maintain. Avoids potential issues with moving parts. Can be adapted easily to account for seasonal variations.

Disadvantages: Full capacity of water butt may not be used depending on storm duration and discharge rate. Blockages e.g. leaves, could prevent operation.

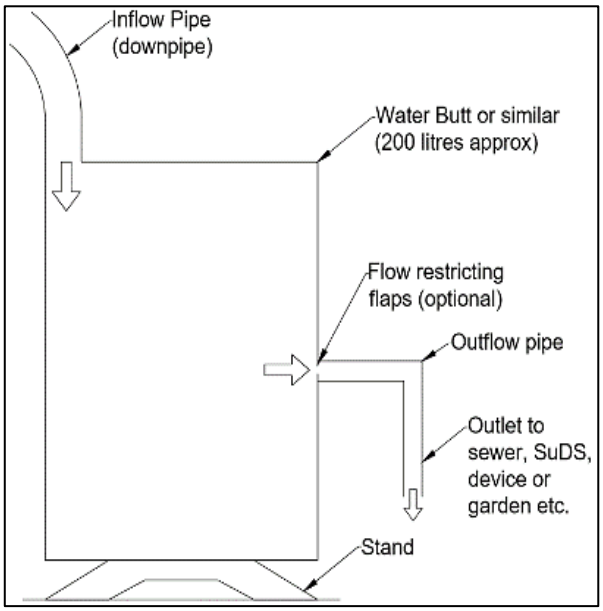

Figure 26: Concept A – simple outlet

Concept B: Siphon Outlet

Overview: Concept is simple. Potential for flow restriction is available through orifice inserts of varying diameter. Discharge commences only when the tank water level exceeds the upper bend of the siphon.

Advantages: Full capacity of tank can be utilised. Simple concept – low cost and easy to maintain. Can be adapted easily to account for seasonal variations.

Disadvantages: Siphon must self-prime in order to operate therefore outlet must provide adequate discharge. Blockages e.g. leaves, could prevent operation.

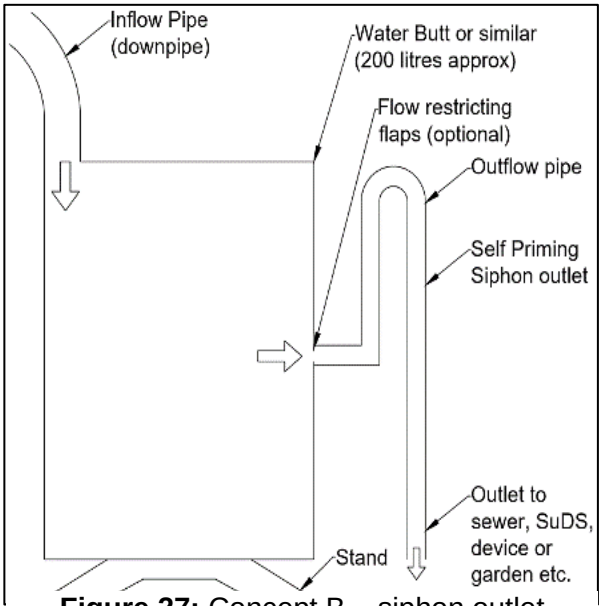

Figure 27: Concept B – siphon outlet

Concept C: Flap Valve

Overview: Similar concept to toilet cistern, whereby a float, connected to a flap, opens and closes as water level rises and falls. Discharge commences as soon as flap opens.

Advantages: Flow restriction is 'live', by being related to tank water level.

Disadvantages: Moving parts complicate operation and construction increasing costs. Long-term weathering/damage to moving parts could lead to additional repair costs and create a non-operational device. Build-up of algae/ sediment on moving parts could prevent/restrict operation. Controlled flow restriction is difficult to achieve with a flap. Operation and construction are unnecessarily complex, potentially increasing costs and operation issues and complicating testing.

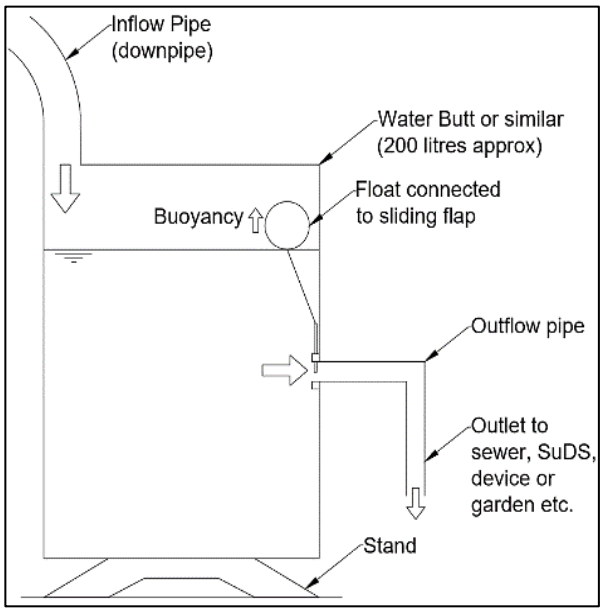

Figure 28: Concept C – flap valve

Appendix B – Water butt prototype construction process.

1. Two 20mm diameter holes marked up and drilled in the side of the tank at equal levels. Imperfections on the edges removed with metal files. Safety glasses and gloves worn for protection during drilling operations.

Figure 29: Drilling holes for pipe attachments

2. Two 12mm ID pipe attachments inserted into the holes with rubber washers at the front face to aid water-tightness. Silicone sealant spread around the back of each orifice to ensure water tightness.

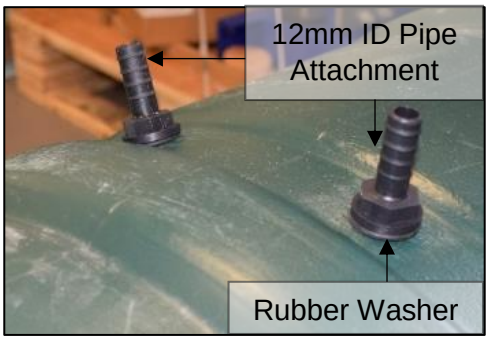

Figure 30: 12mm pipe attachments

3. 10mm hole in the bottom of the tank drilled, and a tapping tool created a threaded opening, into which 8mm ID pipe attachment inserted.

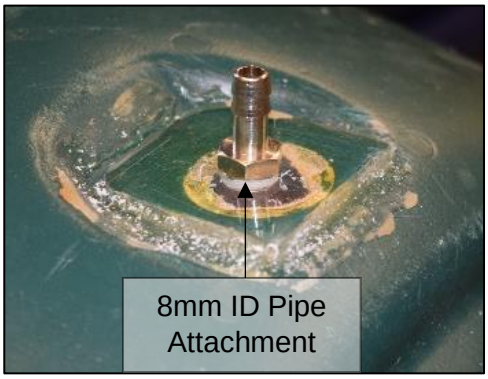

Figure 31: 8mm pipe attachment

4. 12mm and 8mm ID transparent PVC pipes inserted over pipe attachments and secured using reusable plastic pipe clips.

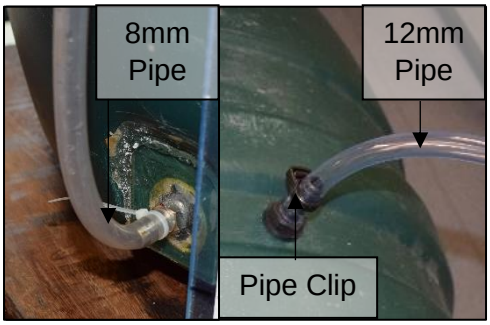

Figure 32: 8 & 12mm PVC pipes

5. Pipe taps, to allow the operator to control the discharge, inserted into the ends of both 12mm PVC pipes and secured using plastic pipe clips. 8mm pipe secured at the top of the tank to indicate tank water level.

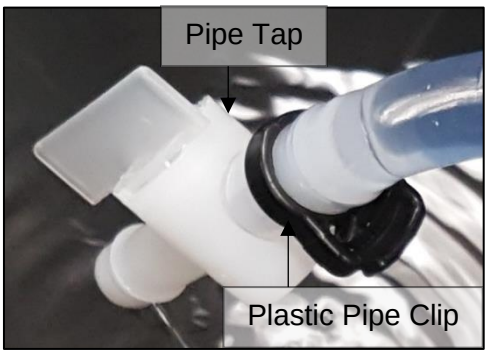

Figure 13: Pipe taps

6. Model left for 24hrs to allow the silicone to set, after which preliminary testing commenced.

Figure 34: Completed model prior to testing

Appendix B contd. - Flow restricting orifice fabrication

A COAST lab technician fabricated the orifice inserts, as workshop machinery was required (milling machine). Ten lengths of plastic dowel were cut to approx. 30mm in length and milled into the shape indicated in figure 37. The thin 15mm OD section fitted into back of the pipe attachments leaving the thicker 21mm section protruding slightly into the tank. A rubber seal was set in on the thinner section to ensure a watertight seal and a secure fixture. Initially, a single diameter was drilled throughout the insert's length however to minimise potential throttling effects, and create a more orifice-like device, the internal diameter of the larger section was widened to 12mm. The dotted lines on figure 37 illustrate this.

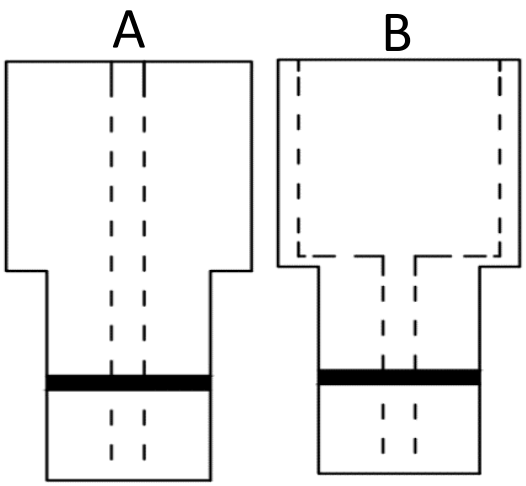

Figure 35: Orifice inserts – revision A and revision B