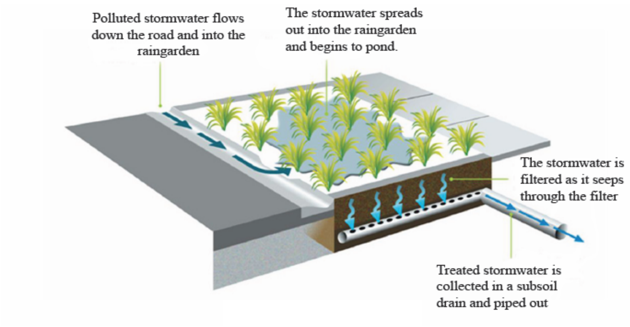
Central West Councils
Salinity & Water Quality Alliance

STORMWATER TO SMARTWATER

S_2S – SUPPORTING TECHNICAL GUIDELINES

Securing the Sustainable Growth of all our Communities



August 2010

Salinity & Water Quality Alliance Member Councils

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Blayney Shire Council

Bogan Shire Council

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Dubbo City Council

Gilgandra Shire Council

Mid-Western Regional Council

Narromine Shire Council

Orange City Council

Warren Shire Council

Warrumbungle Shire Council

Wellington Shire Council

S_2S - Stormwater to Smartwater aims to:

- Promote best practice stormwater management
- Protect our groundwater, creeks, rivers and wetlands by improving the quality of runoff
- Protect human health by improving the quality of runoff
- Manage all the impacts of new development including salinity, runoff quantity & quality
- Use our landscapes more effectively by integrating stormwater management
- Protect our land, creeks and rivers from erosion and siltation
- Add value while minimising development costs
- Reduce potable water demand

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1 Introduction

S_2S - Stormwater to Smartwater (S_2S) is the name given to Council's plan to improve stormwater management across the Local Government Area (LGA). The same plan is being applied across the Central West Region. The provisions in S_2S outline minimum requirements needed to obtain a Development Application and Occupation Certificate.

The S_2S - Supporting Technical Guidelines have been developed to support S_2S.

1.1. Purpose and Objectives

The purpose of this document is to provide the community, developers and Council with the minimum technical requirements and practical guidance which will enable compliance with S_2S.

The S_2S - Supporting Technical Guidelines:

- Explain the minimum requirements for each Performance Target
- Tell you how to comply
- Explain what information is required at Development Application Stage and at Construction Certificate Stage.

1.2. Related Documents

The S_2S - Supporting Technical Guidelines provide much of the information to needed to implement and operate S_2S.

Relevant Australian Standards are referenced. Note: that in the event of a conflict between the S_2S – Supporting Technical Guidelines and AS/NZS 3500, the S_2S - Supporting Technical Guidelines shall take precedence.

Landcom's Managing Urban Stormwater for Soils and Construction Volume 1 – commonly referred as the Blue Book is also a reference document and contains requirements for the management of soil and water during construction.

The Building and Sustainability Index (BASIX) State Environmental Planning Policy (SEPP) is referred to repeatedly but only applies to residential development.

1.3. Relationship with the BASIX SEPP

This section is only relevant to residential development.

The BASIX SEPP applies to all residential development in the State of NSW. S_2S applies to all development that requires approval in the form of an approved Development Application (DA). BASIX is aimed at reducing potable water consumption and greenhouse gases while S_2S is aimed at protecting the environment from damage caused by stormwater runoff from new development.

It is recommended that the most efficient means of complying with this plan can be achieved by firstly working out your minimum obligations under BASIX then work out your minimum obligations required under S_2S before you obtain a BASIX Certificate.

There are some incentives included in S_2S which may make it cheaper to install a larger rainwater tank than one which may be needed to satisfy your BASIX obligations. If necessary seek advice from a registered plumber or licensed builder – they can tell you how much it will cost to construct measures required by S_2S and BASIX.

2 Definitions

Base Flows – are flows that occur during dry weather conditions.

Best Management Practice – the design of a stormwater treatment measure in accordance with current best practice guidelines.

Impervious – a surface that does not allow water to infiltrate into the ground, including roofs, roads, pavements, hard surfaced sports courts, any "sealed" areas and permanent water bodies such as swimming pools.

Infiltration – the downward movement of water from the surface to the subsoil.

Low Flows – flows generated from rainfall events less than the 1 in 5 year ARI storm event including frequent events.

Non potable water – water that is to be used for non drinking purposes such as toilet flushing, laundry use, garden watering, car washing, etc.

On-site Retention (OSR) – retention of water on-site (refer to Retention).

Overland flow path –the path that stormwater may take if the piped or channeled stormwater system becomes blocked or its capacity exceeded. Overland flow paths provide a fail safe system to ensure that stormwater is not likely to cause flood damage.

Peak Flows – the maximum instantaneous outflow from a catchment during a storm event.

Permeable Paving – paving materials that allow infiltration into the soil.

Permissible Site Discharge – the maximum discharge from the site during a 1 in 5 year ARI storm event under pre-development (existing) site conditions.

Pervious - a surface that permits water to infiltrate into the ground.

Potable water – water that is fit for human consumption.

Roofwater – rain (water) that falls on the roof of a building.

Retention – the storing of a form of water for beneficial use. Can apply to all forms of water including rainwater, stormwater and recycled water. May occur by storing water in a tank or by infiltration.

Runoff – interchangeable with stormwater (see Stormwater).

Sewage – any form of wastewater (refer to Wastewater) connected to the sewerage system.

Soil & Water Management Plan (SWMP) - strategies and controls for a development or site to prevent pollution of the environment from all pollutants during the construction stage.

Stormwater – rainfall that is concentrated after it runs off all urban surfaces such as roofs, pavements, carparks, roads, gardens and vegetated open space and includes water in stormwater pipes and channels.

Sump – a cavity or depression where water drains to and which may then be pumped out.

Water Sensitive Urban Design – a design approach promoting sustainable management of the total water cycle through the ecologically sensitive design of homes, streets (and their drainage systems) and whole suburbs.

Wastewater – greywater and blackwater (see Blackwater).

3 Quantity Management During Operation

The following Section documents minimum performance requirements for all developments which have a Quantity Management During Operation Performance Target.

S_2S described the steps involved and they are further clarified here:

1 Determine the total site impervious area

Add roof areas, garage areas, and all paved areas.

2 Reduce the total site impervious area if permeable paving has been used

3 Determine which rainfall region you are located in: more than 800mm/year or less than 800mm/year

4 From Table 2 in S_2S workout your rainfall threshold.

It is 0.022m for areas with less than 800mm/year rainfall and 0.016m for areas with more than 800mm/year rainfall

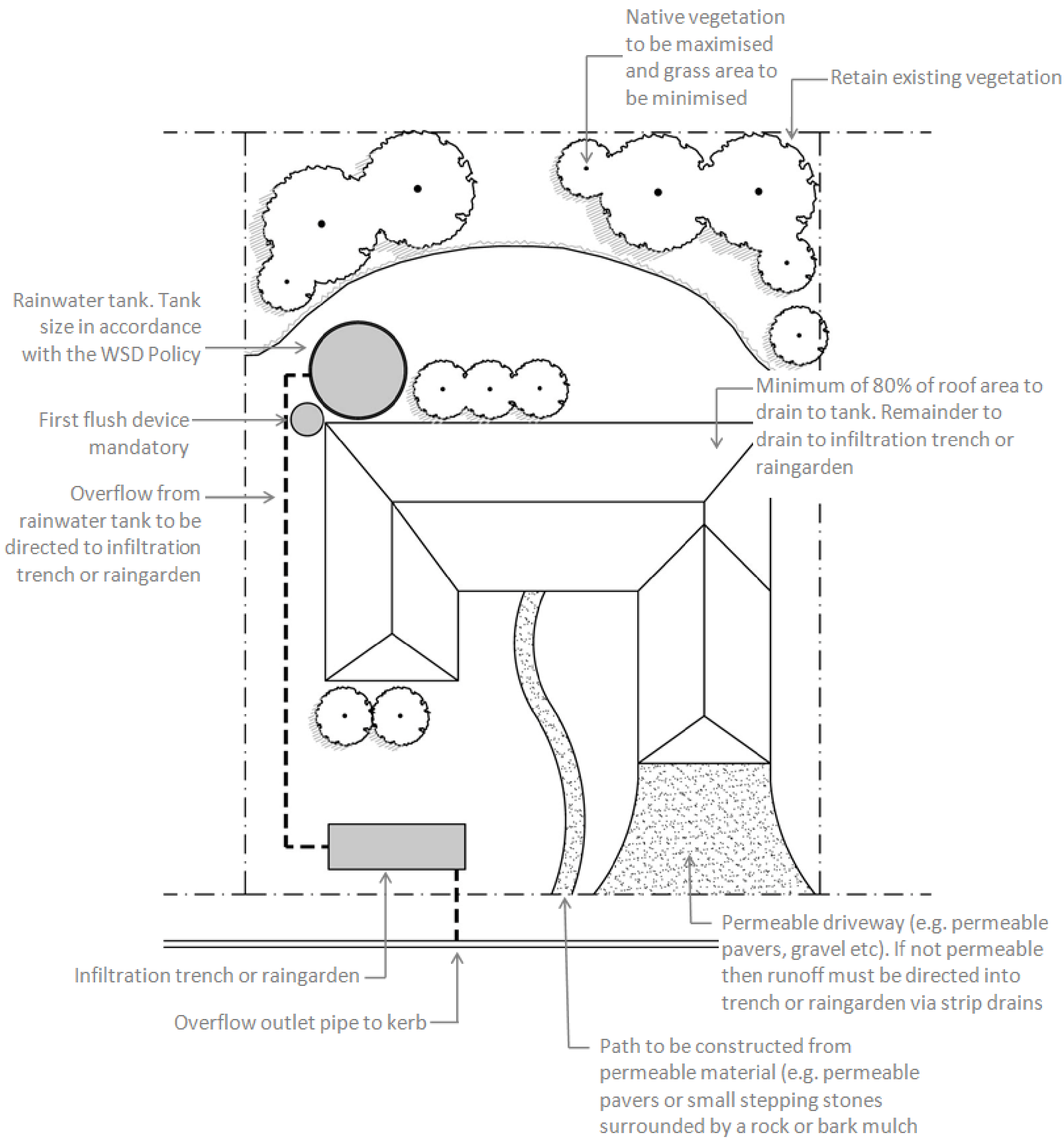
5 Calculate the Runoff Storage Volume

Runoff Storage Volume (m^3) =
Total impervious area (m^2) x rainfall threshold (m)

6 If you chose to use a rainwater tank then you can reduce the runoff storage volume in accordance with Table 3 in S_2S.

7 Choose from either an infiltration trench or a raingarden and calculate the size in accordance with this guideline.

This Section includes guidance and minimum requirements for infiltration trenches, raingardens, porous or permeable paving and rainwater tanks.



Example of single dwelling layout

The single dwelling layout shows a typical residential development with either a rain garden or infiltration trench to dispose of runoff. A rainwater tank may be added subject to BASIX and S_2S.

Note that in some cases where the property falls away from the street and interallotment drainage exists then the trench or raingarden shall be located at the rear of the property to limit discharge into the interallotment system.

3.1. Minimum Requirements for Infiltration Trenches

General Requirements

- Geocellular structures are permitted.
- The Trench is to be wrapped in a non-woven geotextile with a minimum conductivity of 3600mm/hour.
- Gravel is typically used to fill the trench and is to be clean and washed prior to use and free of fines. A 30mm diameter poorly graded gravel is to be used. Use of recycled concrete or bricks is not permitted under any circumstances. All gravel must be inert and be of high compressive strength.
- Trenches are typically 200mm below the surface but can be deeper if required.
- An overflow must be provided as shown in the accompanying sketches. The overflow must be connected to the back of kerb.
- Sediment and debris are to be removed from stormwater before it is allowed to enter the trench unless it can be demonstrated that the proposed system enables easy removal of accumulated sediment. This is very important to ensure that the trench continues to infiltrate runoff and does not clog. An example of a suitable device to remove sediment and debris is the Hydrofilter PE400 by HydroCon or similar. See www.hydrocon.com.au for more details. The selected sediment and debris filter device must be easy to maintain and importantly must be easily and safely accessible.
- Place a covenant or restriction as to user notice over the sediment removing device and trench so that it shall remain in place and in use.
- Are not permitted in areas of high salinity or high groundwater.
- Where groundwater is within 500mm of the base of the trench infiltration shall not be permitted and instead adopt Water Quality During Operation as a Performance Target.
- Trenches or the use of geocellular structures can be placed beneath driveways provided they are structurally sound. Appropriate manufacturer test certificates will need to be submitted with the DA. Evidence showing consideration of creep and point loading of geocellular structures is to be provided.

Trench volume to consider porosity

The infiltration trench shall be able to store the whole of the runoff storage volume. Infiltration trenches are normally constructed from gravel but can also be constructed from plastic geocellular structures that look like milk crates. The space between the individual gravel rocks (is called the pore space) allows about 1/3 of the volume of gravel to be filled with water. In other words every cubic metre of gravel can store 333 litres of runoff. This must be taken into account when sizing your infiltration trench. It is said that the porosity of gravel is about 33% or 0.33.

Equation 1 shows you how to work out the required trench volume:

Equation 1. Required Trench Volume = Runoff storage volume (m^3) / porosity

For example if the runoff storage volume was calculated as $3.8m^3$ and if your trench is to be constructed from gravel then you will need a gravel trench with a volume of $3.8 / 0.33 = 11.4\ m^3$.

Equation 2 shows how to calculate the length or width of a trench if you know the volume:

Equation 2. Volume of a trench (m^3) = length (m) x width (m) x height (m).

Using our example above, if the trench was typically 1m wide and 1m deep then the length of the trench will be 11.4m.

If you chose to use a geocellular structure then the porosity can be as high as 0.90 or sometimes higher. To calculate the runoff storage volume using a plastic cell construction use equation 1 and simply divide the runoff storage volume by the porosity.

For example a plastic cell sold at many hardware suppliers has a porosity of about 90%. If the Runoff Storage Volume was 3.8 m^3 you will need to construct a trench with a volume of 3.8 / 0.90 = 4.13 m^3.

Minimum safe distances to Foundations

Australian Runoff Quality published by the Institution of Engineers, Australia recommends minimum distances that infiltration trenches should be constructed away from building footings. These are shown in Table 1.

Table 1: Minimum Distance of an Infiltration Trench from footings depending on Soil Type

Soil Type	Hydraulic Conductivity	Minimum Distance from Footings
Sandstone	Assumed to be negligible	Do not infiltrate on these soils
Sand	>180 mm/hr	1 m
Sandy Clay	180-36 mm/hr	2 m
Medium Clay	36-3.6 mm/hr	4m
Reactive Clay	3.6-0.036 mm/hr	5 m

Reference: The Institution of Engineers Australia, Australian Runoff Quality Guidelines.

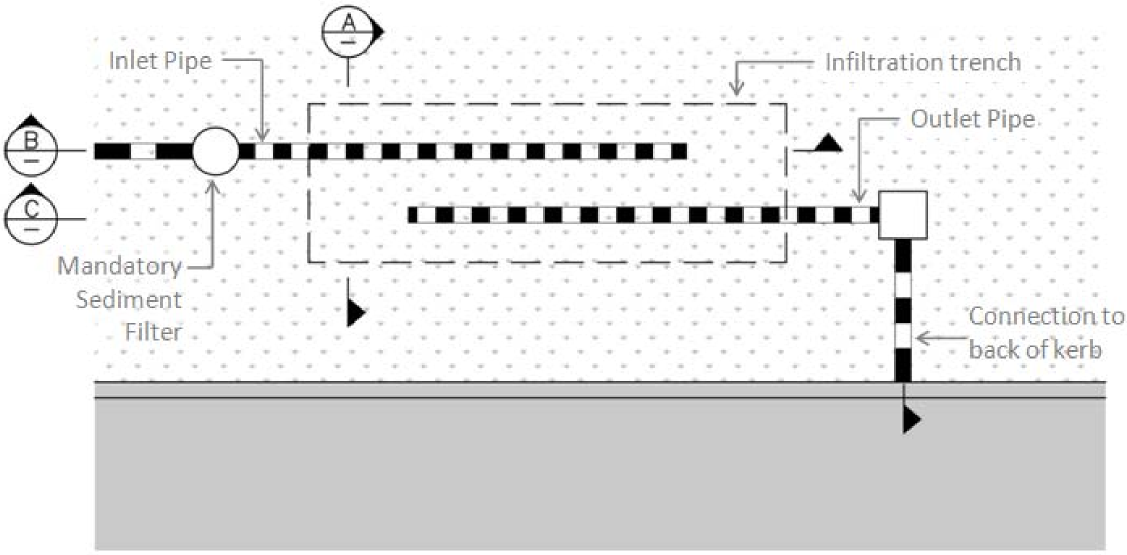
It is likely that your development is located on Medium Clay soils however confirm your soil type with Council who will have a soil map of the area and will be able to advise you if you do not know. Alternately seek advice from a civil or geotechnical engineer.

Manufacturers Recommendations to be adopted

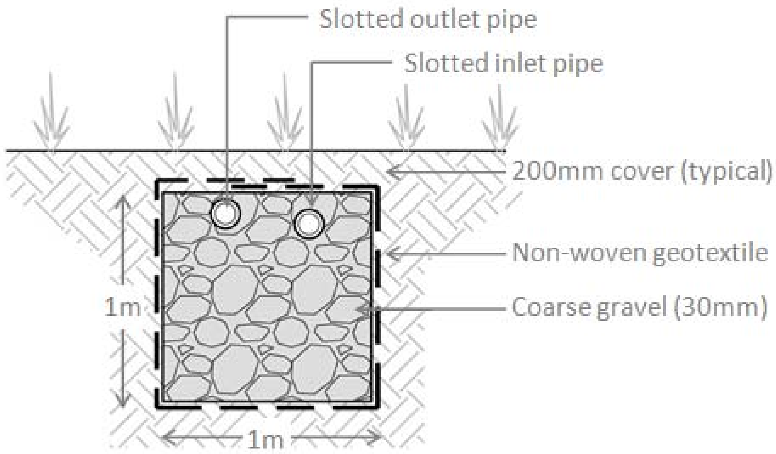
If proprietary infiltration products, such as geocellular structures are proposed for use they shall be constructed in accordance with the manufacturer's requirements. Some plastic cellular products have been shown to fail because manufacturers have failed to consider the impact of creep. All geocellular structures shall therefore consider creep and evidence shall be provided from the manufacturer of such.

Typical Details

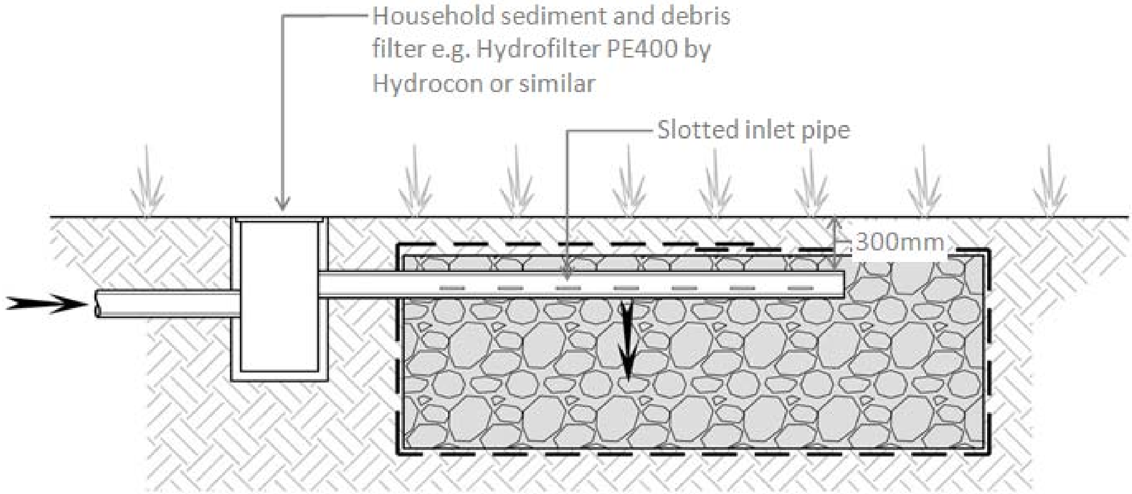
Some typical details follow and provide some guidance as to how to construct an infiltration trench. These are not standard drawings.



Infiltration Trench Plan



Section A: Infiltration Trench Cross Section



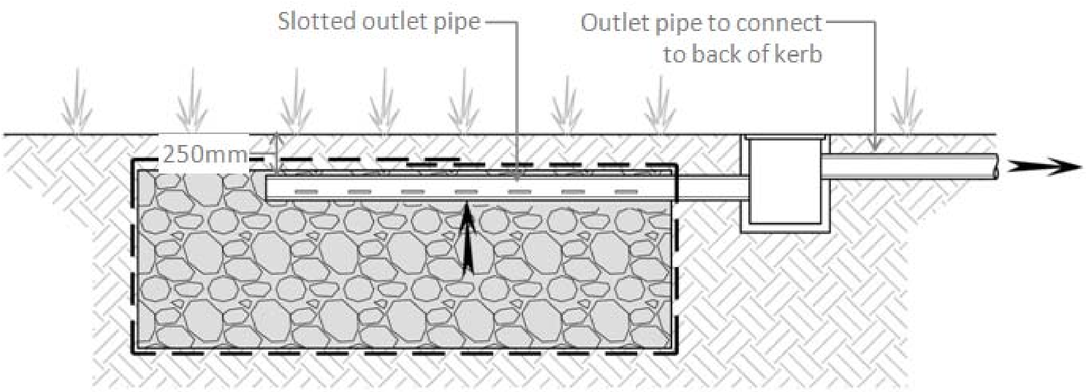
Section B: Infiltration System Inlet

Alternative inlet for draining impervious surfaces

An alternatively inlet for stormwater runoff from impervious areas (eg driveway) may be to direct inflows overland via a grass swale to a gravel trench that extends to the surface. The swale would serve to both convey the water and filter out the sediments to reduce maintenance on the trench.

The swale would have a slope typically less than 5% and be well vegetated to prevent scour during runoff events and trap sediment. The swale can have gentle batters to facilitate mowing and pedestrian movement if desired. The inlet and infiltration trench must be configured to allow a minimum of 100mm surcharge for a gravel surface.

Hint: For this inlet configuration, install the trench at the same relative depths (ie 200mm from surface) with a geotextile wrapping. Add another 100mm layer of gravel on top and the final 100mm is for surcharge.



Section C: Infiltration System Outlet

Details Required at DA and CC stage

For DA provide:

- A drawing of the proposed development
- On the drawing show calculation of runoff storage volume
- Calculations of the minimum trench volume and demonstrate that the proposed volume is enough to store the whole of the Runoff Storage Volume.
- Show the proposed trench dimensions
- Show the proposed trench construction material, i.e. use of gravel and a geotextile blanket around the trench.
- Show the location of the trench on plan.
- Show any rainwater tank and show if any credit is claimed for the use of the tank in reducing the runoff storage volume.
- Show location of all incoming pipes.
- Show location of overflow pit and proposed piped connection to back of kerb. If no kerb exists then show the location of any proposed overland flow path.
- Show the invert level of the proposed overflow pipe at the overflow pit and show the invert level of the pipe where it will discharge at the kerb. This must be done to ensure that the overflow can drain safely to the street.

3.2. Minimum requirements for Raingardens

General requirements

- Runoff from hardstand areas may be directed to the raingarden via:
    - an inlet pit which has a 500mm deep base below the incoming pipe and which allows sediment to settle out before discharging into the raingarden; or
    - direct discharge onto the raingarden surface
- Depth of surface ponding is 200mm
- Suitable water tolerant native plants are to be planted at minimum density of 4 plants/ m^2. Grass can also be used to cover the rain garden however make sure you do not compact the loamy sand media when mowing the grass.
- An overflow pit is to be provided which directs overflows to the street drainage system. Unless stated elsewhere in this document the subsoil is not to be drained using a subsoil pipe. Instead infiltration is to be maximised.
- Minimum depth of the loamy sand filter media layer is to be 500mm.
- Where raingardens are used to meet a water quality during operation Performance Target then they shall be constructed in accordance with the Facility for Advanced Water Biofiltration guidelines – these require a filter media layer as described above and then a transition layer below this to prevent the migration of finer sand particles down and then a gravel drainage layer in which there is subsoil drainage.
- The filter media to be comprised of a free draining sand material but capable of supporting plant growth (at least in the top 100mm)

- Overflows from rainwater tanks are to be directed into the rain garden
- Side slopes on the raingarden are to be flatter than 1 vertical for every 4 horizontal to prevent erosion of the banks. The banks are to be either grassed or formalized using a timber edge strip.

Minimum safe distances to footings

Table 1 **above** provides minimum safe distances to footings and foundations for infiltration. These are to be adopted for rain gardens. Raingardens which are lined to prevent infiltration may be constructed any distance away from a building.

Porosity and surface storage to be taken into account

The raingarden shall be able to store the whole of the runoff storage volume. This section shows you how to calculate the runoff storage volume.

Rain gardens differ from infiltration trenches in two main ways:

1) because ponding of water on the surface is permissible.
2) They use a coarse sand material filter instead of gravel. However both gravel and sand typically have a porosity of 33%.

In order to work out the required size of a rain garden you can take into account both:

- The amount of storage in the sand filter media below ground
- The amount of storage on the surface of the raingarden

To calculate the amount of storage in the sand filter media below ground follow the same steps as you would if constructing an infiltration trench.

Rain gardens are normally constructed from a sand media. The space between the individual grains of sand (this is called the pore space) allows about 1/3 of the volume of sand to be filled with water. In other words every cubic metre of sand can store 333 litres of runoff. This must be taken into account when sizing your raingarden. It is said that the porosity of sand is about 33% or 0.33.

Equation 1 shows you how to calculate the volume of storage provided by the below ground section of your raingarden:

Equation 1. Below ground storage volume = volume of sand used (m^3) x porosity

For example if the volume of sand proposed was 6 m^3 then you are able to store 6 x 0.33 = 2 m^3 of runoff below ground.

In addition to the volume of storage below ground water is stored on the surface of the rain garden. To calculate how much water is stored simply work out the volume of surface storage. You do not need to consider porosity with surface storage.

Because the maximum permitted depth of surface ponding is 200mm one can simply work out how much water is stored on the surface of the rian garden by multiplying the area of storage by the depth. Equation 2 shows this:

Equation 2. Volume of surface storage (m^3) = area of surface storage (m^2) x depth (m) of surface storage.

For example, if you proposed a rain garden with an area of 5m^2 and depth of ponding of 200mm then the volume of water that can be stored on the surface is 5 x 0.2 = 1 m^3 (not accounted for side slopes).

If you needed to construct a raingarden that could store a runoff storage volume of 3.8 m^3 you could size it as follows:

- The minimum depth of the filter media is to be 500mm.
- The maximum depth of ponding is to be 200mm. It will be cheapest to maximise the area of surface ponding which will minimise the area of the trench.

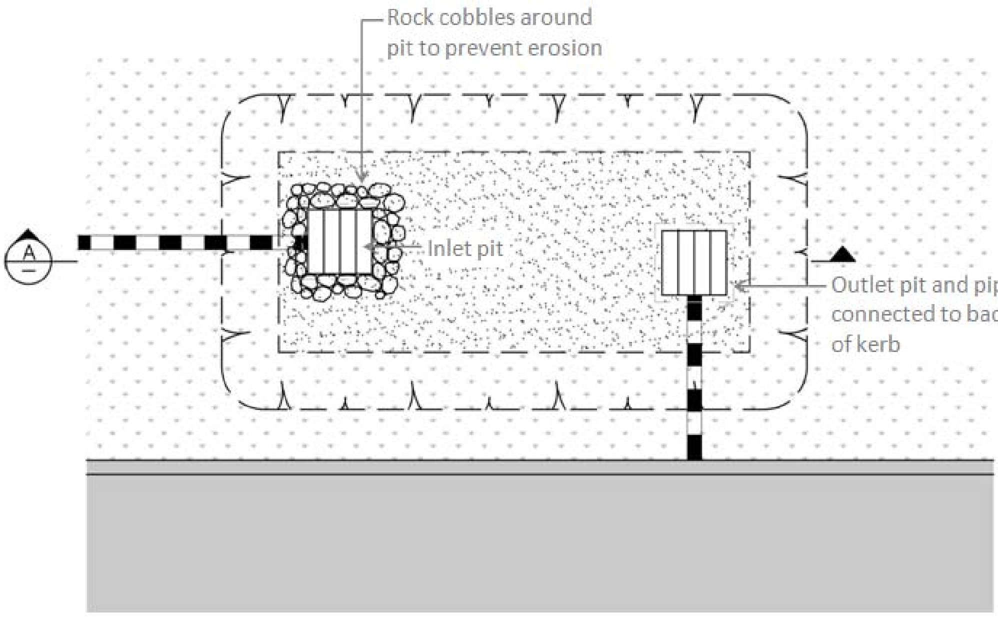
For this example we have then assumed the rain garden will have 200mm ponding and be 500mm deep.

We have worked out for such a case that:

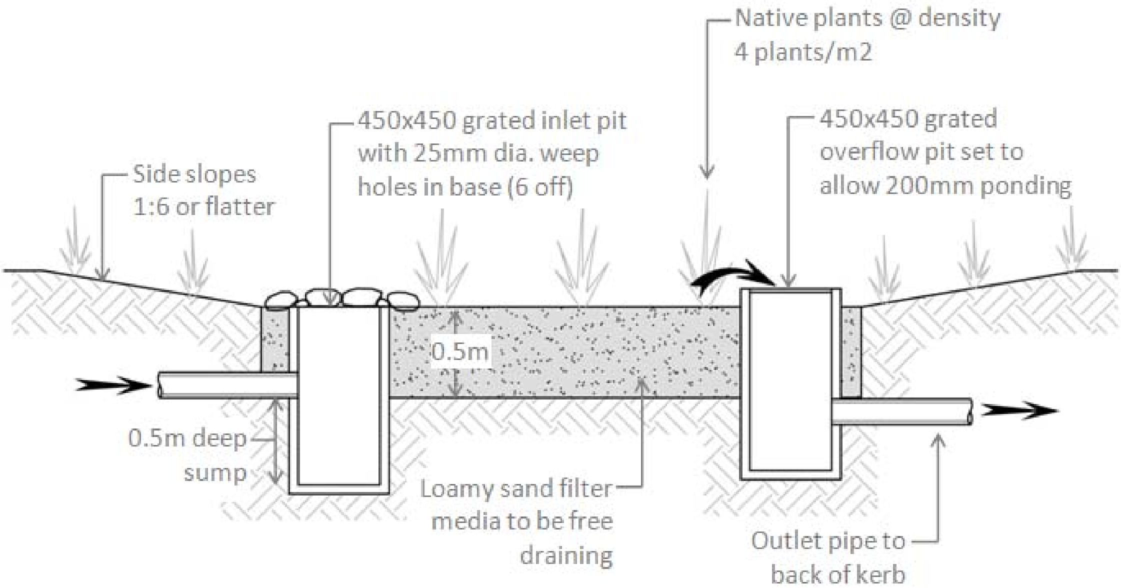
- area of rain garden required (m^2) = the runoff storage volume / 0.365
- Using the previous examples where the runoff storage volume was 3.8m^3, the area of raingarden is: 3.8 / 0.365 = 10.40 m^2.
- The raingarden could then be 3m wide by 3.46m long or any length and width combination which gave you a surface area of 10.4 m^2.

Some typical raingarden sketches and photos are shown below:

Top images courtesy Melbourne Water.



Raingarden Plan



Section A raingarden

Details Required to be submitted at DA stage

For DA provide:

- A drawing of the proposed development
- On the drawing show calculation of runoff storage volume
- Calculations of the minimum raingarden volume and demonstrate that the proposed volume is enough to store the whole of the Runoff Storage Volume.
- Show the proposed dimensions

- Show the proposed construction material, i.e. use of sand and any edging details if one is to be used.
- Show the location of the raingarden on plan.
- Show any rainwater tank and show if any credit is claimed for the use of the tank in reducing the runoff storage volume.
- Show location of all incoming pipes.
- Show location of overflow pit and proposed piped connection to back of kerb. If no kerb exists then show the location of any proposed overland flow path.
- Show the invert level of the proposed overflow pipe at the overflow pit and show the invert level of the pipe where it will discharge at the kerb. This must be done to ensure that the overflow can drain safely to the street.

3.3. Minimum Requirements for Permeable Paving

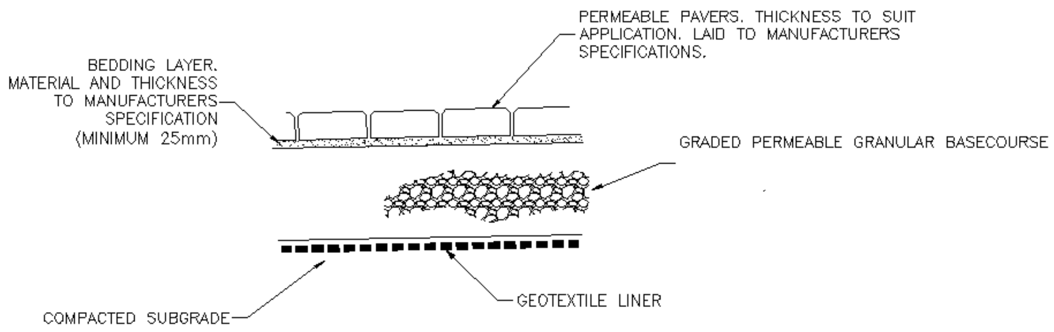
Permeable paving can be used to reduce the impervious area on the proposed development. For example a driveway which is constructed from permeable paving will not contribute to the total impervious area on a site. It may be cheaper to pave a driveway using permeable pavers than to increase the runoff storage volume which will then require a larger trench or rain garden.

Permeable paving is considered appropriate in areas of high groundwater salinity if configured appropriately to ensure there is no increased volumes of water being infiltrated. If your paving is in high salinity areas then ensure there is no increased capture and infiltration.

Permeable pavers can also be used in areas where there is high ground salinity on the condition that no additional runoff is directed to the pavers.

All pavers are to be laid in accordance with manufacturers recommendations.

A typical paving detail is provided below however you will need to seek advice from your builder or engineer.



Details required at DA stage

- Show the extent of any permeable paving
- Show the total area of permeable paving
- Show what type of paving stone will be used
- Show a typical profile of the pavement
- Identify if the subgrade has sufficient bearing strength
- Confirm with Council the adoption of permeable pavers in high salinity areas

3.4. Minimum Requirements for Rainwater Tanks

Rainwater tanks can be used to reduce the Runoff Storage Volume. You need to decide:

- If you want to use a rainwater tank at all – you may need to do so because the BASIX SEPP requires you to do so however there is no compulsion under S_2S to do so.
- If you do decide to use a tank then you need to decide what you want to use the rainwater for. Rainwater is often softer and less salty than potable water and a range of filters easily available today can ensure that rainwater will not stain your toilet or laundry.
- If you do decide to use a tank then you also need to decide how large to make it.
- Table 3 in S_2S shows you how much you can reduce the Runoff Storage Volume depending on the size of the tank, your rainfall region and what you want to use the rainwater for.

General Requirements:

Where a rainwater tank is to be installed to comply with the requirements of S_2S the tank is to be plumbed using a pump and a suitable 3 way flow diversion device or tank top-up system where mains water is available.

Standard Requirements

The tank must be plumbed to deliver rainwater for the nominated end uses. Possible uses can include:

- Hot water supply
- Toilet flushing water
- Laundry washing water
- Outdoor water uses such as garden watering and car washing

- Topping up and/or filling up pools and spas
- Cold water or Drinking provided that an appropriate water filter is used and maintained.

Where a particular development must comply with BASIX, the minimum use of the rainwater shall be in accordance with that required for compliance under BASIX. However the proponent may decide that they wish to voluntarily exceed the requirements under BASIX to minimise the Runoff Storage Volume required by S_2S.

Any rainwater tank must comply with the following installation requirements:

- All raintanks must be installed in accordance with the manufacturer's recommendations;
- Rainwater tank installation must be undertaken in accordance with relevant Australian Standards, Codes and Industry Guidelines (e.g. AS3500:2003 *National Plumbing and Drainage*, HB 230-2006 *Rainwater Tank Design and Installation Handbook*);
- The system must be designed to collect roof water only. Roofwater shall not be sourced from roofs coated with lead- or bitumen-based paints, or from asbestos-cement roofs;
- The system must at least collect runoff from 80% of the roof area;
- Be fitted with a first flush device to prevent potential contaminants from entering the tank;
- If supply is supplemented with a top up system by interconnection with a reticulated water system, backflow prevention is provided in accordance with Australian Standard *AS 3500.1.2* (2003) or subsequent update;
- The tank is enclosed and inlets screened, so as to prevent the entry of foreign matter and to prevent mosquito breeding;
- Tank overflow is to be connected to a retention/infiltration device, swale, stormwater drain or appropriate landscaping such that it does not cause nuisance to neighbouring properties;
- All fixtures connected to the supply system are marked 'RAINWATER';
- Above ground tanks must be located wholly within the building setbacks;
- Above ground tanks shall not require excavation of more than 1 metre from natural ground level to be installed;
- Underground tanks may be located outside the building setback provided they are not visible from the street and do not rise above the surrounding ground. The tank must not be installed within the zone of influence of any foundation of any structure (or a minimum of three metres) unless the tank design is certified by a suitably qualified engineer;
- All roofwater pipe designs shall ensure that an overflow point located lower than the gutters is provided to ensure that flooding of eaves from gutters overflowing does not occur;
- All below ground tanks must have sufficient means in place to prevent the backflow of stormwater from the street system into the tank during a storm event;
- All below ground tanks must be 100% water tight and fully sealed to prevent any ingress of groundwater. All tank openings must be located so that debris and groundwater does not enter the tank;
- The tank shall not exceed a height of 2.0 metres from ground level (including the stand for the tank);
- The tank shall be located at least 450mm from any property boundary;

- Pumps are to be covered or screened to avoid noise nuisances to neighbouring properties;
- Pumps are to comply with *NSW Department of Environment and Conservation (DEC) (2004) Noise Guide for Local Government*;
- Maintain pressure levels in the pressure vessels to minimise noise disturbance to neighbouring properties – this done by regularly pumping up the pressure vessel if required.
- The tank is to be maintained by the property owner to ensure adequate functioning and compliance with accepted health requirements;
- All plumbing work shall be undertaken by a licensed plumber; and

Maintenance

Regular maintenance is important to ensure your rainwater tank works effectively. Recommended maintenance requirements include:

- Regular maintenance of first flush diverters by removing the filter screen in the bottom of the diverter and cleaning. The drip outlet should be monitored for the first 3 rainfall events and adjusted to ensure the diverter is completely drained over a 24 hour period;
- Annually check performance of the float valve or switch assembly to ensure correct operation at bottom water level as specified;
- Check the tank overflow outlet every six months to ensure that it is clear of weeds/sediment and other debris;
- Regularly clean roof gutters to remove leaves, sediment and other debris;
- The accumulation of sludge at the bottom of the rainwater tank should be checked every two years. The removal of which may be required about once every ten years depending on the amount of sediment entering the tank. This can be undertaken by either pumping or siphoning the sludge or the tank can be drained and then cleaned; and
  Note: tanks are considered confined spaces. Access within the tank is to be restricted to personnel with confined spaces training.
- The required frequency of cleaning will depend upon several factors such as local environmental conditions, the condition of the tank inlet and regular performing of other maintenance duties by the owner.


Details to be provided at Development Application Stage:

- Tank location
- Tank height
- Tank size

- Proposed water end uses, i.e. toilet flushing, laundry, hot water, outdoor etc
- amount of credit claimed for the use of the tank;
- Pump location & noise insulation; and
- Overflow locations

4 Quality Management During Construction

The following Section documents minimum performance requirements for all developments which have a Quality Management During Construction Performance Target.

All developments shall install some degree of erosion and sediment control. Depending on the site of the development in question different requirements apply.

Table 2 Minimum Water Quality Management (During Construction) Requirements depending on the disturbed area

Area likely to be disturbed by the proposal (m^2)	Minimum Requirements	Details
< 800 m^2 of disturbed area	*Basic Control Plan*	Council requires at least a hand marked up plan of proposed works and control measures. This plan must be prepared in accordance with these Technical Guidelines
800m^2 to 2,500m^2 of disturbed area	*Erosion and Sediment Control Plan (ESCP)*	This must be prepared in accordance with Landcom's Managing Urban Stormwater (2004) otherwise known as 'The Blue Book'
>2,500m^2 of disturbed area	*Soil and Water Management Plan (SWMP)*	This must be prepared in accordance with Landcom's Managing Urban Stormwater (2004) otherwise known as 'The Blue Book'

The requirements for each of these plans are detailed below.

Appendix A includes some typical erosion and sediment control details which may assist in the preparation of the plans.

Erosion and sedimentation control measures, once installed are to be maintained so as to ensure their continued proper operation until such time as development activities have been completed and the site fully stabilised. Failure to effectively maintain sedimentation controls may result in the responsible individual/corporation receiving an on-the-spot fine of up to $1500 under the Protection of the Environment Operations Act 1997.

Basic Controls Plan

This plan is to be prepared for submission with the DA. The plan may be a simple hand sketch prepared to scale.

For small areas of disturbance (i.e. <800m^2 of disturbed area), Council requires at least a hand marked up plan of proposed works and control measures (for an example see Figure 1).

Basic erosion and sediment controls should be put in place in accordance with the Figures in Appendix A (based on the "Blue Book" (Landcom, 2004)).

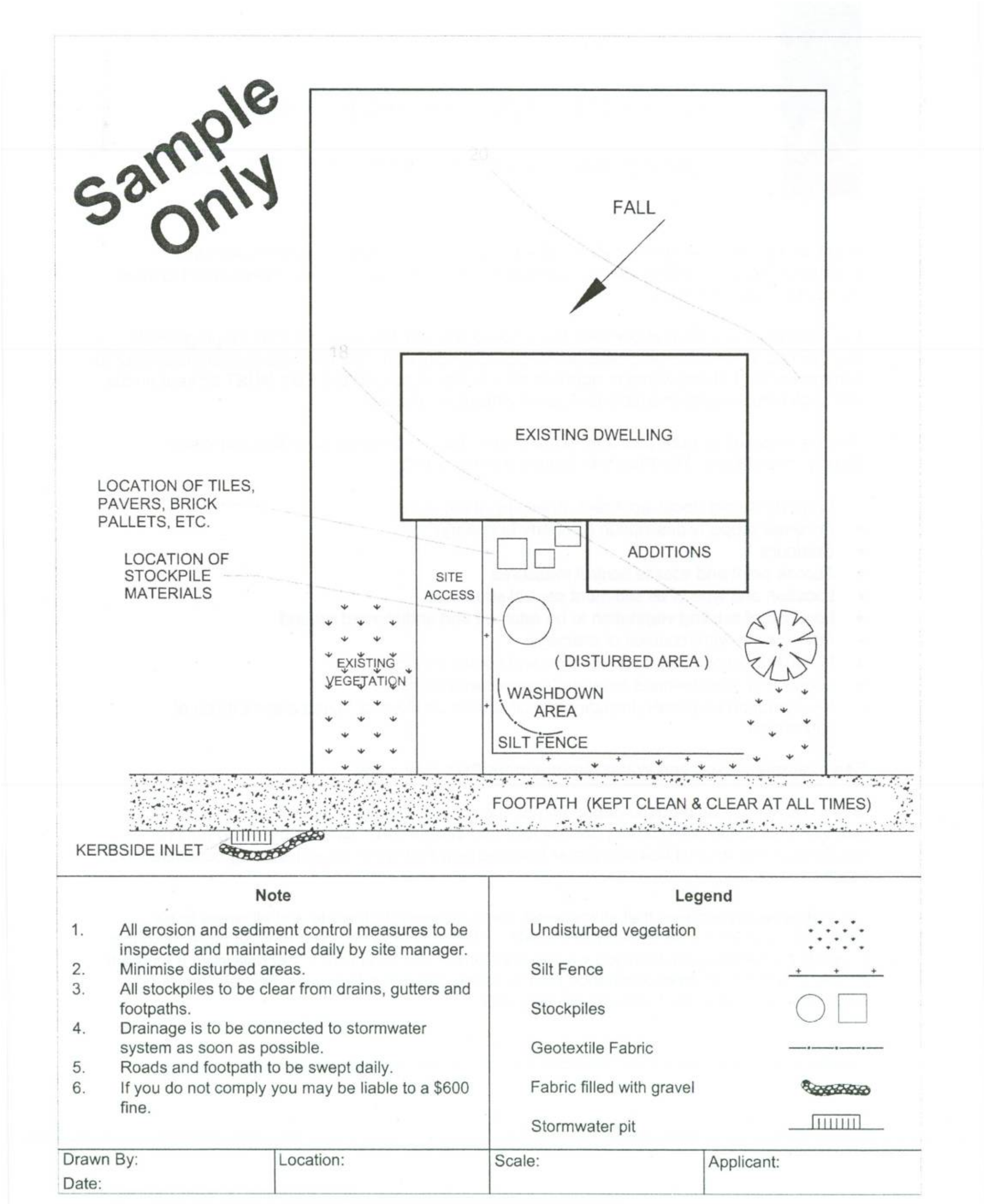


Figure 1: Example basic control plan for small areas of disturbance

Erosion and Sediment Control Plan (ESCP)

For disturbed areas between 800m^2 and 2,500m^2, an ESCP must be prepared for submission and approval during the DA stage of the development. The Plan must be updated continually throughout the design development process and once a Contractor has been appointed they shall ensure that the plan is updated.

The plan must then be executed in accordance with the requirements of the Blue Book.

All ESCPs should show:

- Site layout;

- Approximate location of best management practices (i.e. programs, systems or structures used to mitigate or prevent pollution of receiving waters) where appropriate;
- Where drawings are to scale, show scale at 1:500 or larger;
- Narrative describing how erosion control and soil and water management will be achieved on site, including ongoing maintenance of structures;
- Location of site boundaries and adjoining roads;
- Approximate grades and indications of direction(s) of fall;
- Approximate location of trees and other vegetation, showing items for removal or retention;
- Location of site access, proposed roads and other impervious areas (e.g. parking areas and site facilities);
- Existing and proposed drainage patterns with stormwater discharge points; and
- North point and scale (if to scale).

On the drawing or in a separate commentary, show how the various soil conservation measures will be carried out on site, including:

- Timing of works;
- Locations of lands where a protective ground cover will, as far as is practicable, be maintained;
- Access protection measures;
- Nature and extent of earthworks, including the amount of any cut and fill;
- Where applicable, the diversion of runoff from upslope lands around the disturbed areas;
- Location of all soil and other material stockpiles including topsoil storage, protection and reuse methodology;
- Location and type of proposed erosion and sediment control measures;
- Site rehabilitation proposals, including schedules;
- Frequency and nature of any maintenance program;
- Other site-specific soil or water conservation structures.

Soil and Water Management Plans (SWMP)

For disturbed areas >2,500m^2, a SWMP must be prepared for submission at DA stage and then executed in accordance with the requirements of The Blue Book.

In addition to the data requirements for an ESCP (as listed above), further data requirements for the SWMP include:

- Location of lots, public open space, stormwater drainage systems, an assessment of potential public safety risk;
- Existing site contours (recommended contour interval is 0.5m on gradients of <15%, 1 metre on gradients of 15 to 30% and 2 metres for slopes >30%);

- All necessary erosion and sediment control best management practices (BMPs) (location and general diagrammatic representations);
- Location and engineering details with supporting design calculations for all necessary sediment basins. This must include soil testing to determine the type of basin required and whether flocculation will be required;
- Location and basic details of any other facilities proposed to be included as part of the development or works such as:
    - constructed wetlands
    - gross pollutant traps
    - trash racks or trash collection/separator units
    - "water sensitive" stormwater treatment measures such as bioretention systems,
    - vegetated swales and infiltration measures
- Inspection and Test Plans (ITPs) should be presented as an element of the SWMP identifying:
    - the activity to be undertaken
    - the standard or specification compliance that is being sought
    - the relevant acceptance criteria the method of inspection and/or test and the frequency at which it is to be performed
    - who is responsible for carrying out the inspection and/or test
    - what documentation is to be produced as a record of the inspection and/or test
- Any "witness" or "hold points" required during the works should be identified.

The procedures for preparing the SWMPs are quite involved and guidelines are set out in the manual prepared by the NSW Department of Housing 'Managing Urban Stormwater, Soils and Construction" and must be prepared by a suitably experienced person.

Additional Notes

Note that all materials being delivered to the site and all waste to be collected occur within the confines of the site. If for some reason, you require to store materials or waste on the footpath, then you will require a lease from Council prior to using the footpath.

Typically, water pumped from an excavation will contain sediment and therefore cannot be directly pumped to the drainage system.

Sediment laden runoff from excavations must be first pumped to an adequately sized sediment basin and treated before discharge.

Waste water cannot be discharged to the stormwater system unless it is visually free from grease, oil, solids and unnatural discolouration and free from settleable matter under the Protection of the Environment Operations Act 1997.

A copy of the plan must be kept on the site at all times and be available to Council Officers on request.

5 Quality Management During Operation

This section documents minimum requirements where there is a water quality Management During Operation Performance Target.

There are three ways to comply with this Performance Target.

1) To construct an infiltration trench in accordance with the requirements of Section 3.1 of the Technical Guidelines.

2) To construct a raingarden in accordance with the requirements of Section 3.2 of the Technical Guidelines and guided further below:

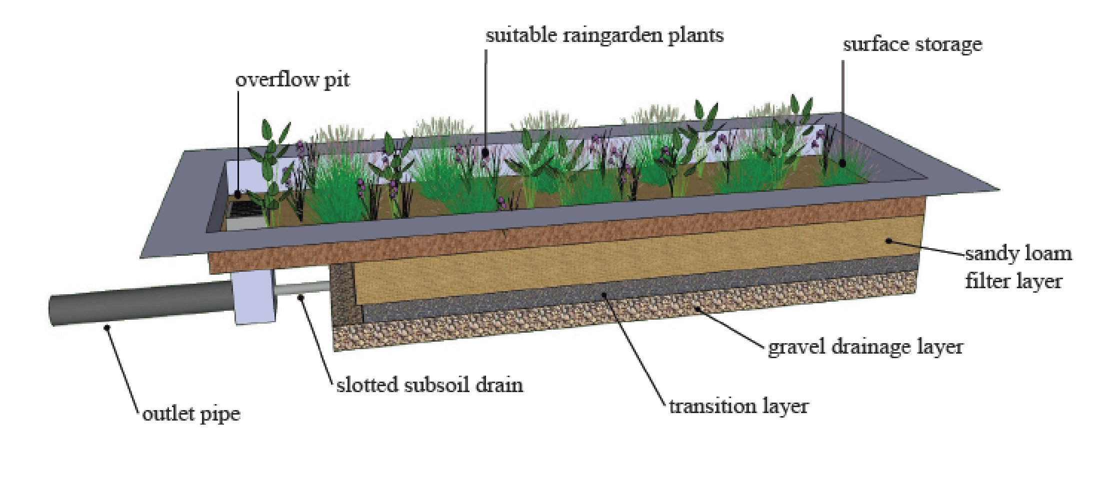
   In addition to the requirements of Section 3.2, it is critical that:

   - The filter media has hydraulic conductivity of 150-250mm/hr, has <3% silts/clays and can support the growth of the selected vegetation.
   - Install a subsoil drainage manifold spaced and sized to ensure that there is capacity to drain a saturated hydraulic conductivity of 250mm/hour.

   The subsoils pipe shall be laid in the base of the raingarden and within a suitably designed gravel drainage layer and transisiton. Refer to the Facility for Advanced Water Biofiltration Adoption Guidelines (FAWB 2009) for further information. These are found on the internet at: http://www.monash.edu.au/fawb/products/

   The section below shows a raingarden designed in accordance with the FAWB Adoption Guidelines. The guidelines require a layered approach ensuring that good drainage out of the raingarden is achieved without the use of a geotextile.

   Note that the subsoil drainage pipe shall NOT be placed in a filter-sock to prevent clogging.



Raingarden for water quality showing various layers

Typically the use of a DN100 ridged slotted subsoil drain will limit pipe outflows to about 8 m^3/hour/pipe. To translate this into a rate expressed as depth (mm) per hour divide 8 m^3 by the proposed area of raingarden. For example if a 10 m^2 rain garden is proposed then the hydraulic conductivity using a DN100 ridged draincoil pipe is = 8 m^3/ 10 m^2 = 0.8 m/hour = 800mm/hour which will be more than sufficient as only 250mm/hour is needed. Note that the loamy sand will then limit the rate of flow down and through the device to about 150mm to 250mm/hour.

By further calculation, one pipe will be sufficient to drain an area of 53 m^2. Additional pipes or the use of smooth bore pipes with lower manning values will be needed to drain larger areas.

Note that the sand media filter will then limit the rate of flow down and through the device to a minimum of 150mm/hour. By further calculation, one pipe will be sufficient to drain an area up to 53 m^2. Additional pipes or the use of smooth bore pipes with lower manning values will be needed to drain larger areas.

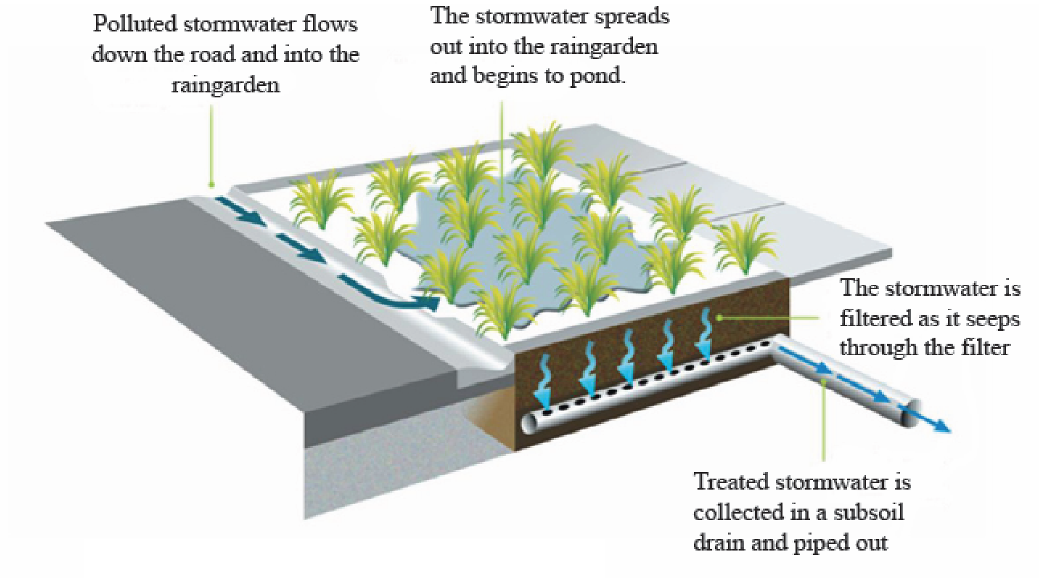


Illustration showing how a raingarden works

To determine the slotting length required in the subsoil drain pipe we can calculate out the area of the openings in the slotted pipe and treat each as an orifice. Use the orifice formula to work out how much flow will enter the pipe per 300mm by 5mm slot:

Using the orifice formula: Q = C x A x (2 X gravity x head difference)^0.5

C is typically 0.67 for a sharp orifice typical of a pipe slot. However being in a gravel media a blocking factor should be applied as well as a factor of safety. It is recommended to adopt 0.15

C = 0.15

A = area of openings

Head difference is the difference in elevation between the water level and opening. The filter media is limiting the rate of down-flow and therefore the hydraulic head is the depth of transition layer – say 100mm above the highest slots.

If you have a deep drainage layer you may have a greater head than used in this example but it is considered that a conservative approach is warranted and the extra head in the drainage layer should be ignored.

Q (per slot) = 0.15 X (0.3 X 0.005) x (2 X 9.80 x 0.1)^0.5 = $3.15\text{x}10^{-4}$ m^3/s or 0.315 l/s is the flow rate expected to enter each slot. In other words, each metre of slot will drain 1.05 l/s. Recall that the flow along the pipe may be larger or smaller.

To achieve pipe full flow rate ($8m^3/hr$) we need approximately
8*1000 / (1.05 x 60 x 60) = 2.1m of slots.

3) To develop a unique solution guided by Australian Runoff Quality or other suitable guidelines and which uses an acceptable continuous simulation water quality model such as MUSIC to demonstrate how compliance with the performance target will be achieved.

   In such a case the proponent shall reimburse Council for engagement of a suitably qualified Peer Reviewer who will review the proposal and verify the modelling results. Note that Council will not accept or adopt a stormwater treatment train which only uses an end of pipe approach. The stormwater treatment train must use source controls located on private property together with other best practice methods so that there is an equitable sharing of life cycle costs.

Deemed to comply solutions – minimum requirements

The two deemed to comply solutions must be sized in accordance with the minimum acceptable sizes stipulated in Table 6 of S_2S.

These requirements are repeated below for convenience:

Area of bioretention and volume of infiltration as a proportion of the upstream impervious area.

Average annual rainfall (mm/yr)	<800	>800
Area of bioretention for roads/carparks expressed as % of the upstream impervious catchment area (based on 100mm depth of surface ponding, 500mm filter media depth and 120mm/hour saturated hydraulic conductivity).	1.0%	1.2%
Minimum volume of storage required inside buried infiltration trench per $100m^2$ of upstream impervious catchment.	$0.5m^3/100m^2$	$0.75m^3/100m^2$

Worked example for both an infiltration trench and raingarden:

A new commercial development will happen on a 1,000 m^2 site. A new supermarket will have a roof area of 500 m^2 and a paved area of 450 m^2.

The builder decides to investigate both a trench and a raingarden.

Infiltration trench sizing:

The total upstream impervious catchment area is 950 m^2. The volume of storage required inside the trench is therefore: 0.5 x 950/100 = 4.75 m^3. Noting that if gravel is used and that it has a porosity of 0.333 then the volume of trench required will be $14.25m^3$. This can be spread over two or more areas.

If a raingarden was to be used it would need to be 1% of the upstream catchment area for areas with a rainfall less than 800mm/year such as Dubbo. This would require a raingarden with a minimum area of 9.5 m^2.

Clearly it is going to be much cheaper to construct the raingarden however there may be instances where trenches are required.

Photos of typical roadside or car park raingardens are shown below:

Requirements for DA

- Prepare a drawings showing the site, the proposed grading, north point, total site area and total impervious area
- On the drawing show the calculation for the minimum size of raingarden or infiltration trench
- Show the proposed raingarden or infiltration trench on the drawing
- Show location of all incoming pipes and overflow pits and pipes. For raingardens show the subsoil drainage pipe and point of disposal of the cleansed water
- Verify that the proposed system will enable gravity drainage to occur, i.e. verify that the pipe inverts and outlet levels will enable the device to function as intended
- Show what specifies of plants will be used in any raingarden
- Show the use of any rock mulches – noting vegetative mulches are not to be used on raingardens because they will wash away.

6 Water Conservation

This Section applies to all non residential development where there is a water conservation objective.

S_2S noted the Performance Targets are:

New development applicants (other than residential and commercial and industrial refurbishments and refits) shall reduce consumption of potable water by 40% benchmarked against a development which uses only potable water and which has no water conserving fixtures or fittings.

Commercial and Industrial refurbishments and refit applicants shall reduce consumption of potable water by 30% benchmarked against a development which only uses potable water and which does not use water conserving fixtures and fittings.

Minimum Requirements

A water conservation report shall be prepared for submission with the DA. The report shall:

- Document historical water consumption – use of past bills is acceptable for retrofits. New development shall estimate its water consumption based on the number of fixture units in accordance with the methods shown in AS3500.
- Document the number of water fixtures (currently in use - if any) and proposed for use.
- Document the methods and techniques used to reduce water consumption to comply with the Performance Targets
- Identify appropriate risk management procedures to ensure that any water used shall remain fit for purpose. If only demand management measures are proposed then a risk management strategy is not required.

Useful sources of information include:

- Your local water utility – ask Council if in doubt.
- http://www.savewater.com.au/
- http://www.waterwisensw.com.au/

7 Salinity Prevention

In areas where there is high ground salinity:

- **Infiltration shall not be used**
- Only the use of lined bioretention devices or raingardens are acceptable.
- The devices shall be lined to prevent infiltration into the surrounding soil. The use of HDPE, bentonite impregnated geotextiles are acceptable. If other types of liners are to be used then the proponent shall prove the liner is capable of preventing infiltration.
- The devices shall otherwise be designed according to Section 5 of this Supporting Technical Guideline.

8 References

Australian and New Zealand Environment and Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) (1992). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.*

BASIX website [http:www.basix.nsw.gov.au]

Committee on Uniformity of Plumbing and Drainage Regulations (CUPDR) (September 2003). *Circular No. 18 Guidelines for Plumbing Associated with Rainwater Tanks in Urban Areas (Where a Reticulated Potable Water Supply is Installed).*

Department of Energy, Utilities and Sustainability (2005). *Draft Regulatory Framework – management of Private Decentralised Recycled Water Systems*.

Department of Local Government (2004). Circular to Councils 04/25 *Approvals for Installation and Operation of Systems of Sewage Management (Including Gryewater Diversion Devices)*

Institution of Engineers. *Draft Australian Runoff Quality*

FAWB (2009). *Adoption Guidelines for Stormwater Biofiltration Systems*, Prepared by the Facility for Advancing Water Biofiltration (FAWB), March 2009

Landcom (2004) reprinted July 2006. *Managing Urban Stormwater: Soils and Construction* Volume 1 4th Edition (the Blue Book).

NSW Environment Protection Authority (1997). *Draft Managing Urban Stormwater: Treatment Techniques*.

NSW Health (April 2000). *Greywater Reuse in Sewered Single Domestic Premises.*

Standards Australia (2003). Australian Standard: *National Plumbing and Drainage AS/NZS 3500:2003.*

Standards Australia (1997). Australian Standard: *Installation of UPVC Pipes AS 2032:1997*

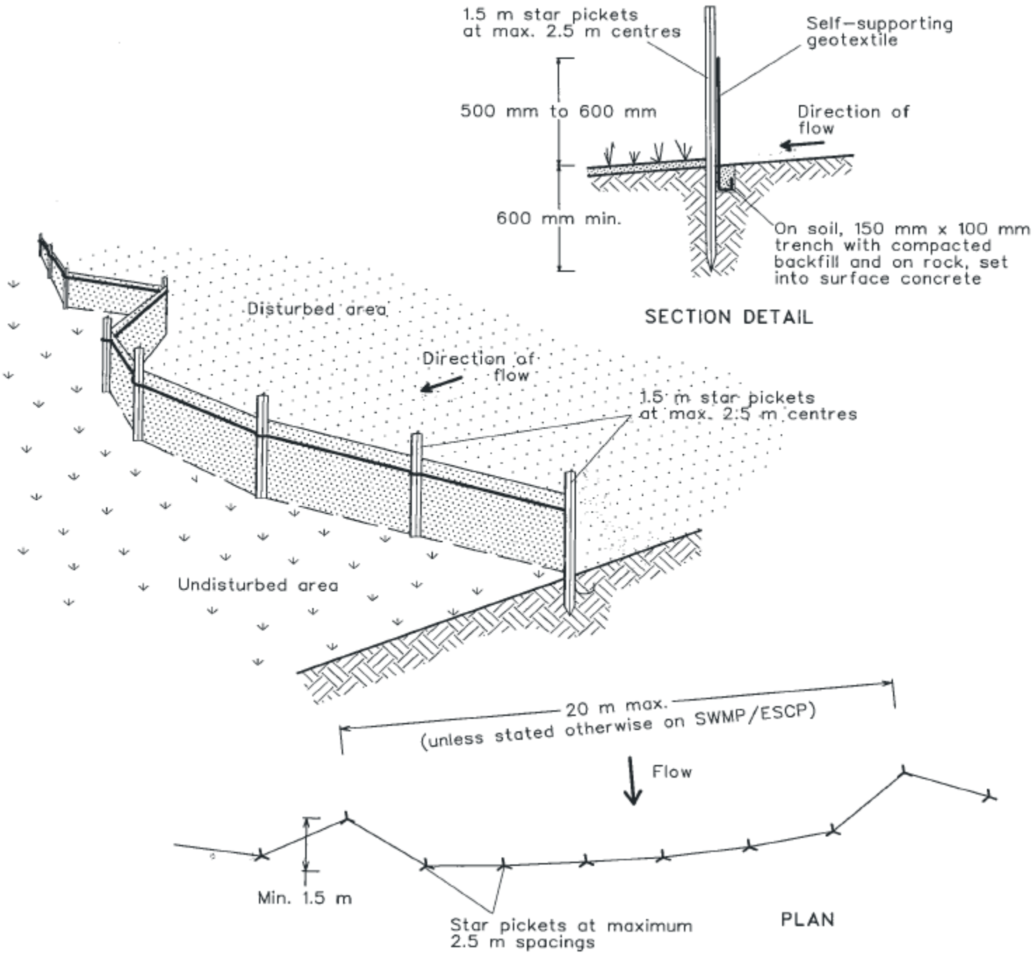
Standards Australia (1992). Australian Standard: *Fixed platforms, walkways, stairways and ladders – Design, construction and installation AS 1657-1992*

Standards Australia (1989). Australian Standard: *Loads on Buried Concrete Pipes AS 3725:1989*

Standards Australia (2004) Australian Standard: *The storage and handling of flammable and combustible liquids AS 1940:2004*

9 Appendices

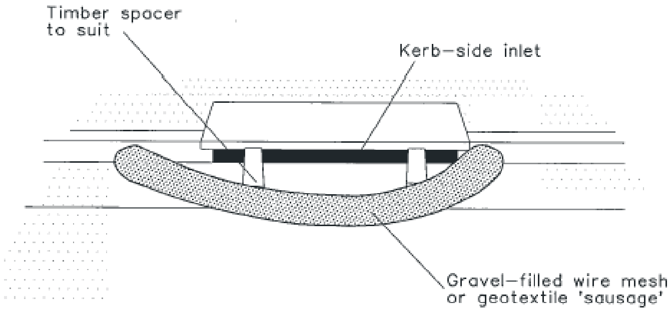
Appendix A – SWMP standard drawings (filter sock, sediment fence, straw bale filter)

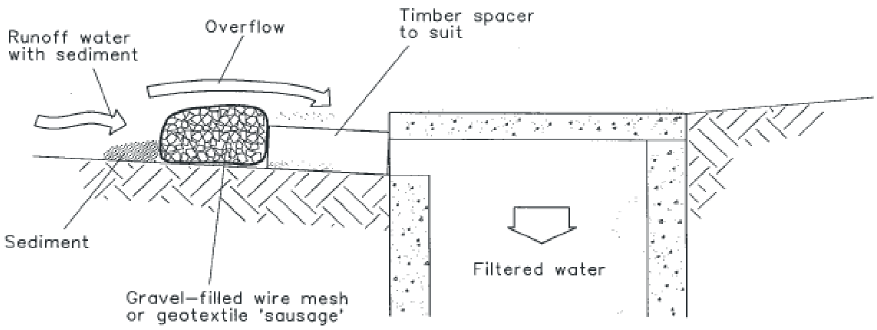


Construction Notes

1. Construct sediment fences as close as possible to being parallel to the contours of the site, but with small returns as shown in the drawing to limit the catchment area of any one section. The catchment area should be small enough to limit water flow if concentrated at one point to 50 litres per second in the design storm event, usually the 10-year event.
2. Cut a 150-mm deep trench along the upslope line of the fence for the bottom of the fabric to be entrenched.
3. Drive 1.5 metre long star pickets into ground at 2.5 metre intervals (max) at the downslope edge of the trench. Ensure any star pickets are fitted with safety caps.
4. Fix self-supporting geotextile to the upslope side of the posts ensuring it goes to the base of the trench. Fix the geotextile with wire ties or as recommended by the manufacturer. Only use geotextile specifically produced for sediment fencing. The use of shade cloth for this purpose is not satisfactory.
5. Join sections of fabric at a support post with a 150-mm overlap.
6. Backfill the trench over the base of the fabric and compact it thoroughly over the geotextile.

SEDIMENT FENCE **SD 6-8**





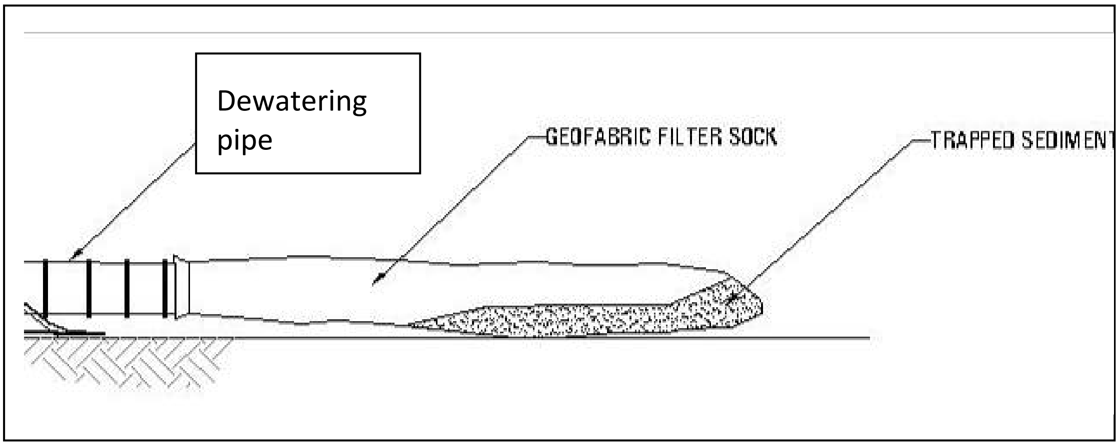
NOTE: This practice only to be used where specified in an approved SWMP/ESCP.

Construction Notes

1. Install filters to kerb inlets only at sag points.
2. Fabricate a sleeve made from geotextile or wire mesh longer than the length of the inlet pit and fill it with 25 mm to 50 mm gravel.
3. Form an elliptical cross-section about 150 mm high x 400 mm wide.
4. Place the filter at the opening leaving at least a 100-mm space between it and the kerb inlet. Maintain the opening with spacer blocks.
5. Form a seal with the kerb to prevent sediment bypassing the filter.
6. Sandbags filled with gravel can substitute for the mesh or geotextile providing they are placed so that they firmly abut each other and sediment-laden waters cannot pass between.

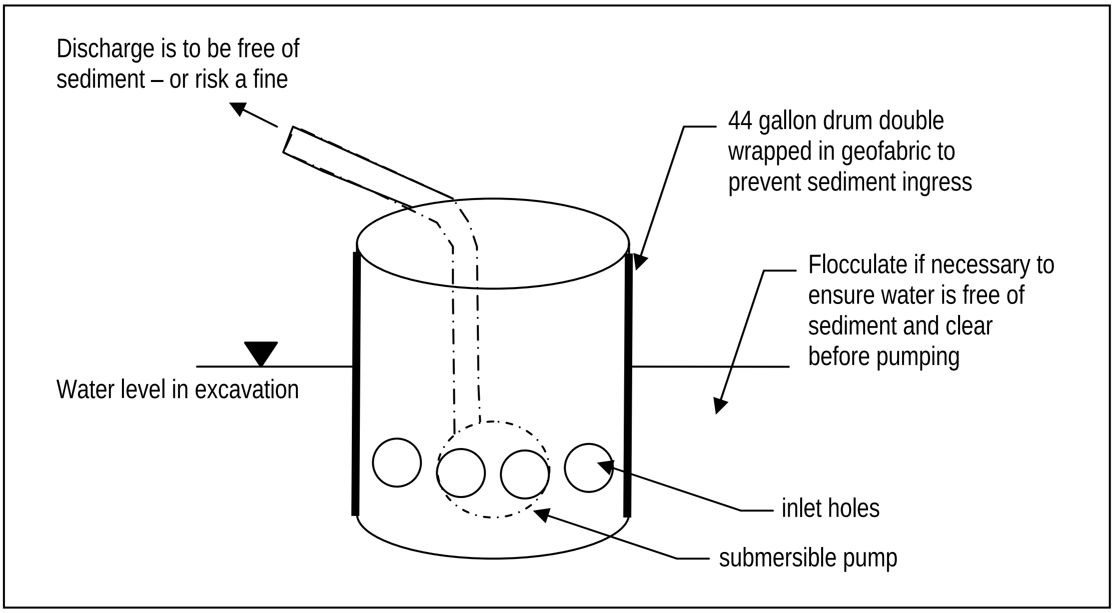
MESH AND GRAVEL INLET FILTER **SD 6-11**

(Source: Landcom, 2004)

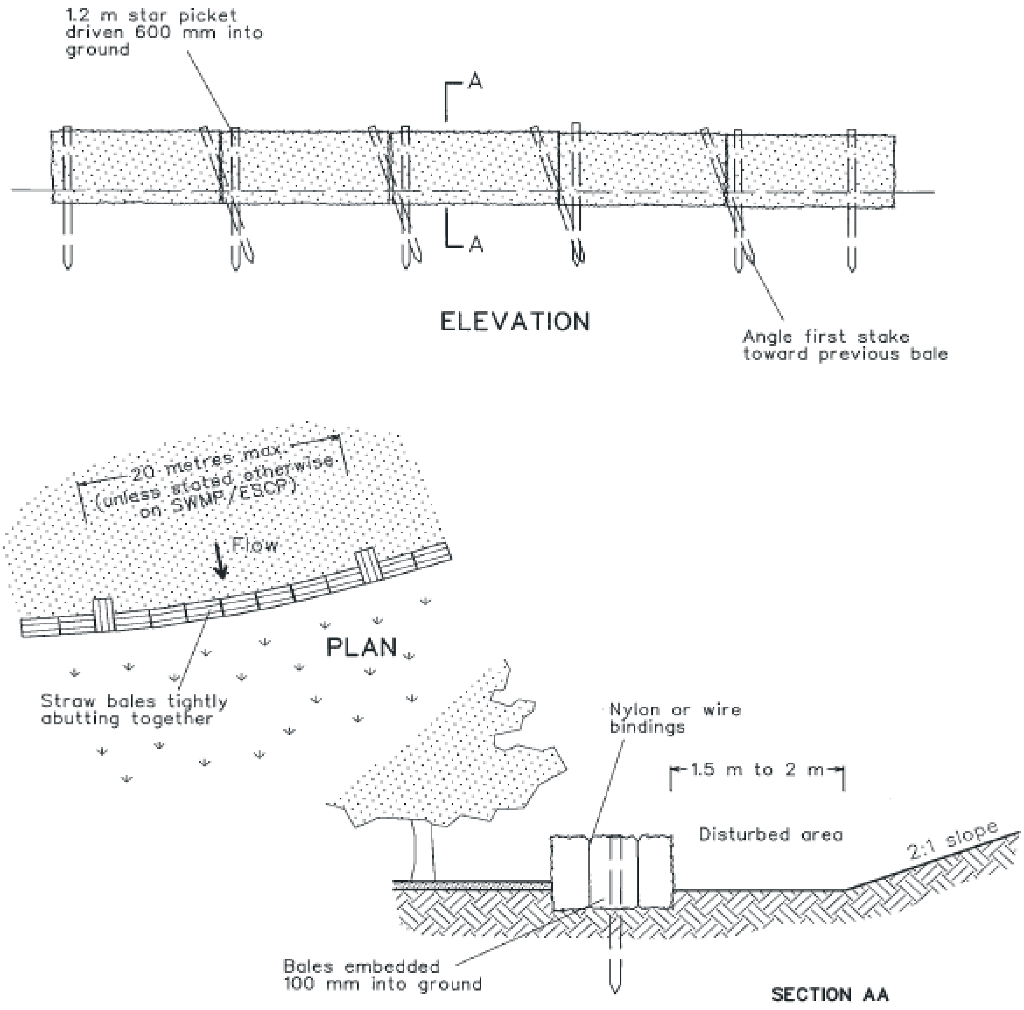


Dewatering Filer Sock - Detail

The above detail is to be applied when dewatering an excavation. A fine geofabric filter sock is to be placed over the dewatering pipe to trap fine silts.



The above detail is to be applied when pumping out an excavation.



Construction Notes

1. Construct the straw bale filter as close as possible to being parallel to the contours of the site.
2. Place bales lengthwise in a row with ends tightly abutting. Use straw to fill any gaps between bales. Straws are to be placed parallel to ground.
3. Ensure that the maximum height of the filter is one bale.
4. Embed each bale in the ground 75 mm to 100 mm and anchor with two 1.2 metre star pickets or stakes. Angle the first star picket or stake in each bale towards the previously laid bale. Drive them 600 mm into the ground and, if possible, flush with the top of the bales. Where star pickets are used and they protrude above the bales, ensure they are fitted with safety caps.
5. Where a straw bale filter is constructed downslope from a disturbed batter, ensure the bales are placed 1 to 2 metres downslope from the toe.
6. Establish a maintenance program that ensures the integrity of the bales is retained - they could require replacement each two to four months.

STRAW BALE FILTER **SD 6-7**