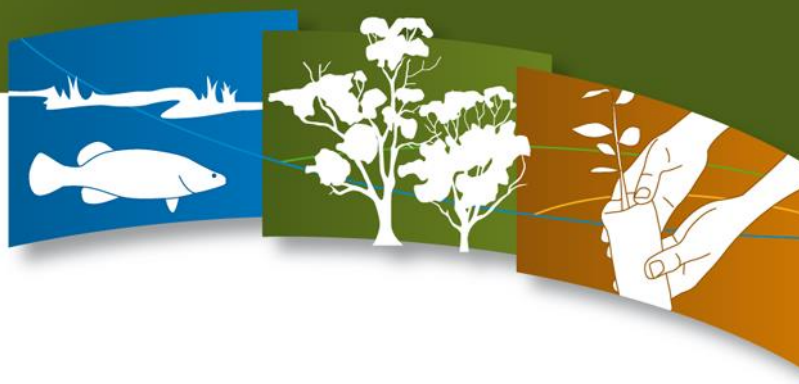
Works on Waterway Guidelines
Stormwater Outlets



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Introduction

Stormwater outlets can include man-made excavations or structures and the natural tributaries, which provide controlled or uncontrolled entry of runoff into the river or creek system.

Stormwater outlets can provide outfall for both rural and urban runoff generated from the following sources:

- Rainfall.
- Irrigation runoff.
- Effluent disposal from intensive agriculture or industry.
- Stormwater outlets can include the following:
- Natural depression or waterway.
- Excavated earthen drain inlet.
- Pipe structure.
- Rock chute.
- Flume or drop structure.

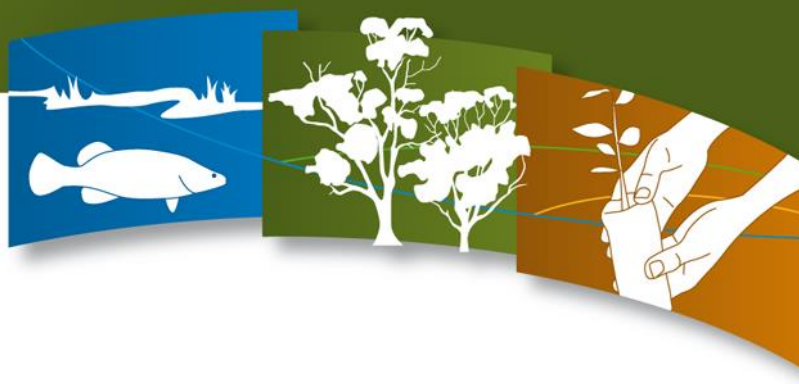
Potential Waterway Impacts

The potential impacts of stormwater outfalls are summarised below.

- Increased flows in the stream.
- Erosion of bed and banks at the outlet.
- Sediment inputs.
- Entry of untreated farm effluent.
- Irrigation tailwater flows discharging high levels of nutrients and salt.
- Litter and pollutants entering waterways.
- Potential loss of access.
- Potential headward erosion in the bed of the outfall.

Use of stormwater drains to convey runoff from rural and urban areas will result in increased sediments, nutrients and various contaminants entering waterways. This will contribute to degradation of water quality for downstream water users and for the in-stream environment.

The proposed works need to be consistent with the North Central CMA Water Quality Strategy (North Central Waterway Strategy 2014-2022) and the relevant local government stormwater management plan. The assessment of applications



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for outlet works should also examine the broader issues of where the water is coming from and what measures are in place to address water quality.

Assessment Criteria

Design Flow

The scale and type of drainage works will determine whether the rate of runoff from the catchment is significantly affected. The receiving waterway must have the capacity to cater for runoff from the drainage works.

Where the proposed drainage works consist of minor depression regrading (depth of cut less than 300 mm), the increase in flow rate can be expected to be minor and acceptable.

In cases where substantial drainage earthworks are involved, or the catchment is modified for urban or intensive agricultural development, or the waterway capacity is limited, the applicant should demonstrate the effect of the works on the receiving waterway. If the increased flows cause increased flow levels in the receiving waterway it will be necessary to ensure the proposed works limit the peak drain design flow to a more acceptable flow, preferably the pre-development flow from the catchment. Peak flows from catchments can be effectively reduced with appropriately designed retardation basins within the catchment.

Drainage scheme designs would normally include a hydrological and hydraulic design to address water quantity and quality issues and this should be submitted with the application for assessment by the CMA.

Scour Protection

Site characteristics will determine the most suitable type of outlet structure. Provisions must be made for flows to enter the stream under a range of flow conditions without causing erosion to the bed or banks of the stream, or the outfall drain itself.

It is suggested that the outlet structure should have a minimum capacity based on a 50% AEP rainfall event with provision for greater flows to be conveyed into the receiving waterway, possibly utilising a rock chute spillway.

The applicant should provide adequate hydraulic design details to enable the outlet structure to be fully assessed. These include design flow, exit velocities, likely tailwater levels in the receiving stream and also the impact of above design flows. Figure 1 provides an example of a well-designed outlet which limits scouring.

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Figure 1- Well designed stormwater outlet

Outlet Type

There is often a considerable drop between the stormwater outlet and the normal low flow level in the stream. It is therefore necessary that the entry to the stream be designed to dissipate the excess energy without causing erosion.

Suitable arrangements for dissipation include:

- Piped outlet which is fully submerged at normal low flow level.
- Pipe outlet with concrete headwall partly submerged.
- Pipe outlet with a concrete baffled energy dissipater.
- Pipe outlet above water level with rock riprap – maximum drop 1 meter.

The pipe outlet velocity should be limited to the type of energy dissipation being used. Generally, an exit velocity up to 1.5 m/sec would be acceptable.

Rock riprap will be placed around the outlet structure. The design and type of stormwater outlets should aim to limit flood extent and be integrated into the landscape as seen in the drawings at the end of this document. Figure 2 provides an example of a poorly designed stormwater outlet.

Figure 2- Poorly designed stormwater outlet

Cut-offs

A common outfall problem is when flows bypass the outfall pipe, either under or around the pipe or upstream headwall, leading to failure of the structure and extensive bank erosion. The design should be checked for adequate concrete cut-offs at the upstream end, mid-way along the pipe structure, and at the outlet end. The concrete cut-off should extend at least 450 mm into solid ground.

For rock chutes, a rock cut-off can be incorporated into the structure. All bed and bank rock must be properly keyed into the foundations to a minimum depth of 600 mm.

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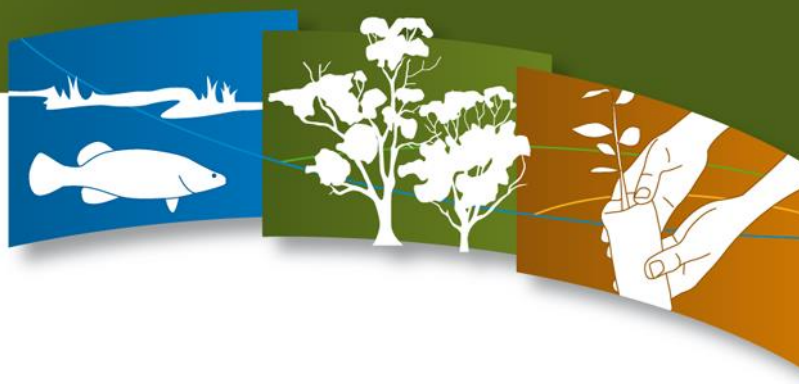

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Water Quality

The drainage works must include measures to protect the beneficial uses of waterways. The principles developed in the Urban Stormwater Guidelines (Victoria Stormwater Committee, 1999) should form the basis for the assessment and can be applied in both rural and urban areas. The principles are as follows:

- **Preservation**: Preserve existing valuable elements of the drainage system, such as natural channels, wetlands and stream-side vegetation.
- **Source Control:** Limit changes to the quantity and quality of stormwater at or near the source. This can include land use planning, education, regulation and operational practices to limit changes to the quality or quantity of runoff before it enters the drainage system.
- **Structural Control**: Use structural measures, such as treatment techniques or detention basins, to improve water quality and control discharges.

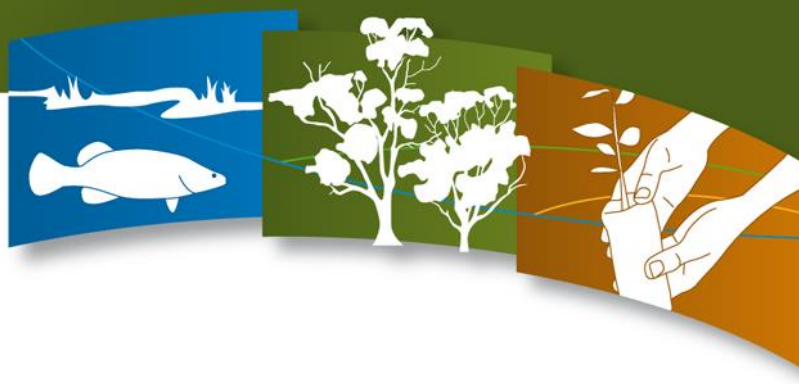
Application of these principles to particular types of stormwater outlets is described below:

Rural Drains

- Grass lined drain bed and batters, i.e. Grassed floodways.
- In-line and off-line dams to act as sediment traps.
- Runoff from irrigated properties to only enter the stream as overflow from a drainage reuse system.
- Dairy wastes isolated from drainage system and re-used on the property.

Urban Drains

- Education program.
- Signage on drainage pits (e.g. Drain flows to river).
- Sedimentation traps on earthworks sites.
- Street sweeping with debris collection.
- Kerbside filter traps.
- Gross pollutant traps.
- Sedimentation ponds or shallow wetland systems with macrophytes.
- Diversion of high flows around sediment ponds and wetlands.



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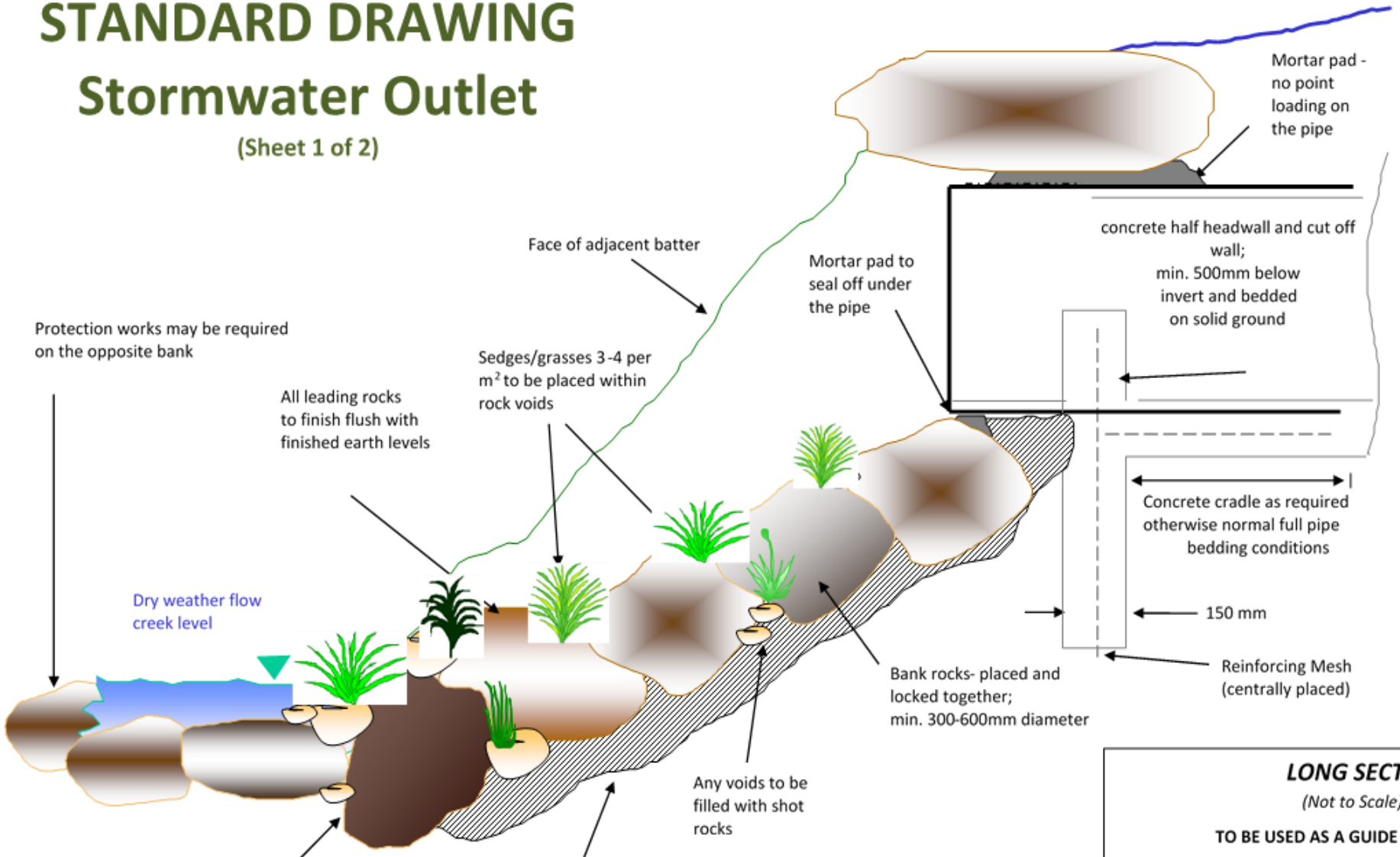
The type of measures that are included will depend on the characteristics of the catchment, i.e. rural, residential, commercial or industrial, catchment area and topography.

Best practice also includes regular maintenance of the system elements, particularly the removal and off-site disposal of entrapped material from litter traps, or the harvesting and off-site disposal of macrophytes in wetland systems. The applicant shall provide details of the operation and maintenance program. Stormwater systems should be designed to limit the negative affect on water quality and align with the principles of water sensitive urban design.

Public Safety

There is potential for outlet structures to be a hazard to the public. The proposed works should be checked for potential problems such as open pits. The responsibility for operational safety rests with the owner of the structure and regular inspection and maintenance is required.

STANDARD DRAWING
Stormwater Outlet
(Sheet 1 of 2)



LONG SECTION

(Not to Scale)

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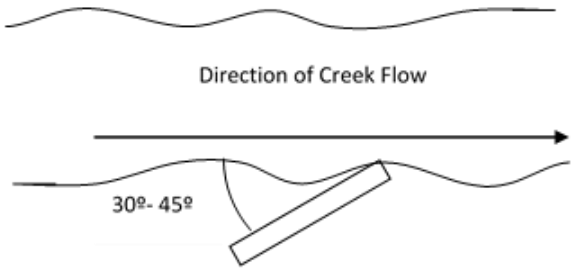
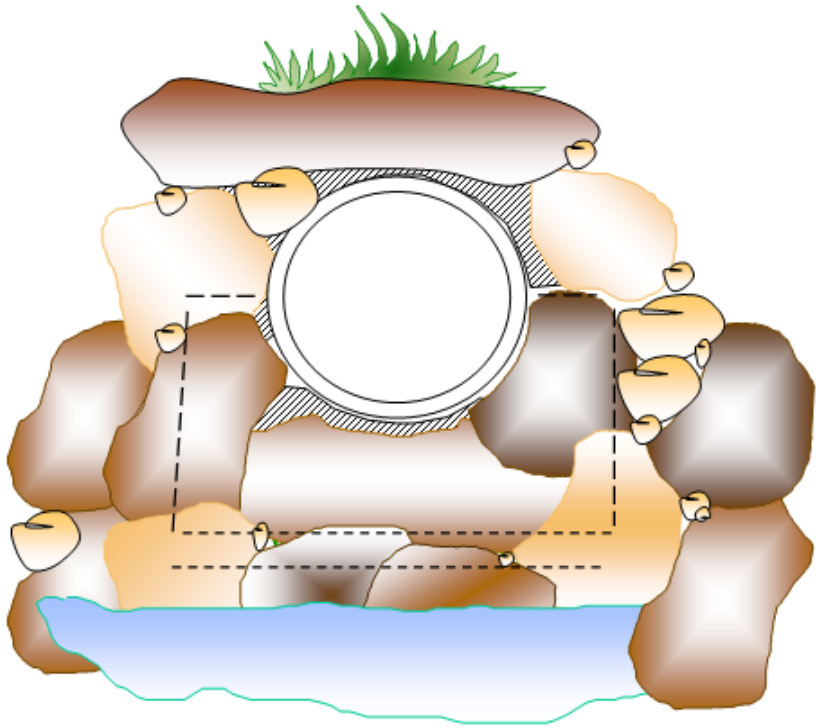
STANDARD DRAWING
Stormwater Outlet

(Sheet 2 of 2)





1.1 PROCEDURE

- Excavate/box out to enable toe and perimeter rocks to be placed first.
- Key toe rocks to two-thirds of their diameter into undisturbed material.
- Infill the chute with rock spalls. The contractor must use methods for handling and placement of rock that will avoid segregation of rock size fractions.
- Rock must be carefully placed into position. Rock must not be dumped directly.
- It is imperative that rock spalls used to form the rock chute are well graded with minimal voids to produce a blanket of interlocking rock.

1.1.1

1.1.2 GENERAL NOTES

- 1.5 m/sec max. outlet velocity ;
- Outlet pipe to be set back into the finished batter slope, pointing a max. of 45 degrees downstream ;
- Native sedges & grasses must be placed in between voids within the rock chute at 3-4 plants per m^2 to provide additional screening. Native shrubs & small trees must also be placed to stabilise the ground where needed.
- Rocks abutting the pipe must have a mortar pad between the rock and the outside edge of the pipe (no point loading) ;
- Rockwork protection is required for the bed and banks, from the end of pipe to the low flow water level. Rock protection is required for the full erosion projection of the opposite bank and bed as required for the water flow profile when the outlet is flowing full;
- Rocks <u>within the base</u> to be placed on a road-base bedding to ensure the stormwater discharge is flowing over and around the rocks down into the creek, and <u>not</u> underneath.
- Disturbed areas of existing bank resulting from these works are to be stabilised with revegetation using locally indigenous species.
- The outlet must be integrated into the bank and surrounding landscape to minimise visual impact.
- Toe and side rocks are to be adequately keyed into the bed of the creek.
- All voids shall be filled with smaller rocks.
- Appropriate silt/debris control measures must be installed within the waterway, downstream of the worksite.

FRONT VIEW (Not to Scale)
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