

Guidelines



Culverts

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Culverts are arched, boxed or piped conduits that allow water to pass under a road or other structure. They are usually made of concrete or galvanised corrugated steel pipe. The location and size of the culvert is determined by the stream flows and the need for it to be safe during high flows. Culverts should be designed to minimise alteration of the riverbed or the width of the channel.

Thorough planning and specialist advice are essential. Managing problems after construction is more expensive than dealing with them in the planning stage. Ensure that all planning and approvals processes have been met. All structures should be designed by a suitably experienced engineer in consultation with a coastal geomorphologist.

Use these guidelines in conjunction with the information provided in Chapter 12 when planning works and engaging consultants and contractors to ensure the proposed works use the most effective methods and minimise the risk of causing damage to coastal values.

Planning

Identify any natural or cultural values at the work site that require protection and seek specialist advice. Consider Aboriginal and maritime heritage, threatened species, wildlife habitat, important vegetation communities, and recreational values.

Design culverts to accommodate requirements of threatened or highly valued species. Time works to avoid disturbance to sensitive species such as shorebirds.

When planning watercourse crossings where fish are likely to be present, consult a specialist and seek technical information on culvert design and placement.

Specialist and/or engineering advice will be needed on a range of technical issues (e.g. hydrology and hydraulics).

Ensure the connectivity between the waterway by minimising any constriction of water flow and simulating natural channels and water flows.

Plan works in watercourses and estuaries to coincide with low water flows, unless this may have adverse effects on plant communities and animals (especially threatened aquatic, estuarine and marine species).

Approvals

Approval and permits will be required. All works on Crown Land which includes all land below the high tide mark will require approval from Crown Land Services. A planning permit from the local council may be required. Other approvals and permits may be required depending on the nature of the works and the site.

Site selection

Choose a site that minimises interference with natural coastal systems and processes (including wave action and seasonal cycles of sediment accretion/erosion) and marine hydrology (seasonal patterns of tidal flushing, currents, etc).

Avoid unstable areas such as dunes, slip-prone areas, very erodible soils, natural drainage channels and stream banks. Avoid shoreline or marine vegetation, floodplains, wetlands and other sensitive sites, as far as possible.

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Avoid works in areas infected with phytophthora root-rot disease wherever possible or employ good hygiene measures to reduce spread.

Choose sites away from significant cultural or natural heritage values (e.g. heathland vegetation may contain rare or threatened species and is of high conservation value). A survey may be required to identify these values.

Avoid areas where the works could mobilise contaminated sediments or in acid sulfate soils (ASS). Disturbing ASS may lead to corrosion and loss of structures and environmental damage that requires remediation. Watch out for indicators of ASS such as rotten egg smell or yellow deposits when digging.

Design

Structures need to accommodate all water flow conditions.

Ensure the culvert's capacity can accommodate peak flow volumes, so that the top of the inlets are not submerged in peak flows by more than 0.5 m (in low to moderate-high erodibility class soils) or 0.1 m (in high to very high erodibility class soils), unless measures are used to protect against erosion where the water discharges at the downstream end.

Open-bottom culverts, such as box culverts, with the natural streambed running through them are preferred to other culverts. Ensure they do not break up the streambed material, and are large enough not to constrict flows or trap debris during normal flow conditions.

If an open-bottom culvert is not suitable, the following applies:

One large culvert spanning the width of the waterway is preferable to two or more small culverts, as it is usually more hydraulically efficient.

If multiple culverts are needed to span the riverbed, one or more should be slightly lower than the others to accommodate low flows and allow fish to swim through.

Place the culvert perpendicular to the flow, to minimise the length needed (less than 4 m) and to allow fish to swim through.

Use culvert pipes of sufficient strength (e.g. reinforced concrete pipes) to handle anticipated bearing loads. The minimum diameter of culvert pipes should be 300 mm (or 375 mm in areas with high or very high erodibility class soils, where the risk of culvert blockage or failure is high).



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Ensure culvert gradient is gently sloping and similar to stream gradient. To allow fish passage, avoid using culverts on a waterway with a gradient of more than 2% (1:50). The gradient immediately downstream of the culvert should be less than 5% (1:20), so fish can approach the culvert outlet.

If possible, design the culvert so its hydraulics (water flows) are similar to those of the stream, and the weakest fish species can swim through. The water depth should allow the largest fish species to remain submerged.

Ensure the culvert has at least 600 mm of space above the typical base flows (low flows) of the stream, so it is light enough inside to encourage fish to enter and swim through.

Ensure that water velocities in the culvert are similar to those at the site before the culvert was constructed. There should also be no differences in the flow rates upstream, inside the culvert, and downstream.

Cementing baffles or large angular rocks (typical of the area) along the base of longer concrete culverts will reduce flow velocities and allow aquatic animals to pass through.

Lining the base of the culvert with a rough concrete finish and/or natural substrate will increase turbulence and make it easier for fish to swim through. Velocities of less than 0.3 metres per second will allow most native fish to swim through a 5 m culvert.

To control erosion at the outlet, place a rip-rap apron (V-shaped to allow fish passage at low water levels) at a distance of up to 6 culvert diameters beyond the outlet, particularly if the slope of the riverbed is greater than 2% (1 in 50).

Ensure the capacity is large enough to accommodate the anticipated debris and sediment load.

Construction

All works crew and contractors should be briefed on the environmental standards to be met by the project and adequate supervision should be provided to ensure these standards are met.

Obtain advice from a coastal engineer about the appropriate materials and methods for the site.

Minimise disturbance to the shoreline or to riverbanks, bed and natural flows.

Stabilise watercourse beds (e.g. by armouring the bed with large rocks). Use energy dissipaters if there is insufficient natural protection against scouring or erosion.

Do not obstruct passage of aquatic fauna during construction. Avoid works during breeding times for local fish species. Seek specialist advice.

Minimise disturbance of coastal wildlife. Time works to avoid shearwater and shorebird breeding times and penguin breeding and moulting times.

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Employ sediment and erosion control measures during construction to minimise sediment flow into the waterway.

Operate construction equipment in a manner that causes the least disturbance to the watercourse or estuarine bed and banks:

- Keep machinery out of the channel as much as possible, and minimise entry points
- Do not dump construction materials (e.g. concrete) or push fill into the water
- Locate surplus fill at least 10 m from the shoreline, estuary or watercourse banks, separated by an effective filter strip of vegetation

Keep water away from fresh concrete for at least seven days, where feasible. Fresh concrete is highly alkaline and can pollute the water for fish and other fauna. Some fast-drying mixes may allow a shorter curing time.

Rehabilitation

Restore the natural vegetation as soon as possible to minimise the potential for bank erosion. It may be necessary to use geotextiles to stabilise banks.

Ongoing monitoring and maintenance of rehabilitation work is required.

Maintenance

All culverts should be maintained regularly to minimise the risk of causing erosion and flooding, or obstructing the passage of fish and other animals. Regular inspections and maintenance should be carried out on new crossings, after storms and periods of high flow, and before fish and other animals begin migrating.

Minimise disturbance to the passage of fish and other aquatic fauna during maintenance works.

Inspection and maintenance should include the following:

- Remove debris and sediment from culverts, if more than a third of the entrance is blocked, to allow passage of fish and other animals.
- Check erosion is not a problem.
- Check structures are secure and not becoming a hazard to the public.

More Information

Why do fish need to cross the road? — Fish Passage Requirements for Waterway Crossings, Fairfull & Witheridge 2003

Tasmanian coastal works manual: Chapter 15, Page & Thorp 2010

Transport Tasmania's Roadworks Specifications

- *Roadworks Specification R34—Drainage Maintenance*

Waterways and wetlands manual, Gallagher 2003