8.0 STREAM WORKS

Works in or around streams have the potential to have a direct impact on watercourse habitat (e.g. by habitat disturbance or destruction) and on watercourse ecology (such as through sediment and temperature related effects). Note that erosion and sediment control measures are not usually constructed in channels with permanent flow. This is because the catchments are too large, the permanent flows limit the effectiveness of any controls, they can impede fish passage and they cause their own effects because of the degree of construction disturbance.

Great care is therefore required for works in and around watercourses to avoid potential effects as much as possible. Where this is unavoidable, then specific control measures and methodology are required to minimise potential adverse impacts.

The following sets out some general information and highlights a number of ideas that can help minimise the effect of works near or in watercourses. Section 8.1 discusses harvesting techniques around water bodies, section 8.2 discuses considerations associated with crossings and finally, section 8.3 outlines some practices associated with streamworks.

8.1 Harvesting Operations

As mentioned in previous sections, vegetation removal in the Auckland region is currently a permitted activity according to Rule 5.4.1.2 of the Auckland Regional Plan: Sediment Control (Nov, 2001). It is recommended that you consult this plan before undertaking harvesting operations near streams. In general, the following aspects should be followed:

- Where practicable and safe, trees should be felled or pulled away from Category 1 watercourses, particularly on steep or unstable slopes or edges. Where trees cannot be felled or pulled away from these watercourses, they should be felled directly across the watercourse and extracted after limbing and deheading.
- Slash and other debris should not be placed or left in Category 1 watercourses where it will divert or dam this watercourse, prevent fish passage or destroy significant habitat.
- Logs should not be hauled through or along Category 1 watercourses. If the operation necessitates the extraction of logs across these watercourses, and there is no alternative route, then a permanent or temporary crossing will be required (see section 8.2).
- At the end of harvesting, all of the margins of these watercourses should be stabilised as soon as practicable but no later than 12 months from the start of the harvesting operation.

8.2 Crossings

The ARC currently does not distinguish between temporary or permanent crossings when assessing the need for a resource consent. At present, crossings over Category 2 (ephemeral)[1] watercourses will not require an ARC consent.

In general, crossings over permanently flowing watercourses (Category 1), will need consent except for small structures (*eg* culverts less than 20m long and 900mm diameter). You will need to check with the ARC to confirm that this situation continues to prevail and what the thresholds are. In these situations, the works and measures need to comply with the relevant conditions of permitted activity of the Proposed Auckland Regional Plan: Air, Land & Water. When a resource consent is required, then specific design will be required to be submitted to the ARC along with the consent application.

8.2.1 'Dry' Stream Crossings (Category 2 Watercourses)

Many gully systems in the Auckland region that are 'dry' during summer are part of a sensitive eco-system and still part of the watercourse system. Often the harvest plans require ground based machinery to cross these ephemeral watercourses, sometimes resulting in major disturbance of the watercourse, which can mobilise significant quantities of sediment when rain occurs. These areas should be protected from damage and options include 'corduroying' or armouring the crossing with logs, which is a common practice on wet landings.

It is considered good practice that these structures are removed at the completion of the works.

8.2.2 Permanently Flowing Stream Crossings (Category 1 Watercourses)

Stream crossings should be kept to a minimum. Where they are necessary, choose the method of crossing to minimise disturbance of the bed and banks of the stream. For example, bridges which are in general less disruptive than culverts, are effective ways to keep equipment out of flowing streams and avoid significant disturbance of the stream banks and bed. Temporary or portable bridges should be used instead of culverts where permanent structures are not needed.

The construction or installation of crossings should be undertaken "in the dry" where possible and have regard to fish migration periods (which is usually September to November). Temporary crossings should be removed as soon as works have been completed and the area left in an erosion proof state (this would normally involve some sort of re-stabilisation measures and perhaps the supplementary use of biodegradable fabrics and similar).

[1] Refer to definition section for classification of Category 1 and 2 streams in the Auckland Region.

It is important to note that works in watercourses are regulated by a Regional Plan (Air, Land & Water). It is recommended that you consult this plan to determine the specific requirements necessary for operating in these watercourses.

8.2.3 Stream Crossing Considerations

- Construct the crossing at right angles at a point where the stream bed is straight and uniform. As well as simplifying construction, this practice helps to ensure that tree stems are not turned until clear of the crossing, and minimises loose soil being swept into the watercourse. Leave high stumps to assist this outcome.
- Place crossings so that they do not unduly constrict stream channels or impede floodwaters.
- Avoid all unnecessary use of equipment in the watercourse.
- Construction activity should be limited to periods of low flow (generally late summer). Pick a dry period in which to undertake the works.
- Minimise cut and filling at stream crossings and any other disturbances to stream banks and channels.
- Use materials that are clean, non erodible and non-toxic and avoid using soil as fill.
- A stabilised spillway (stabilised with rock, concrete or appropriately anchored geotextile) must be provided to allow for over topping of the crossing due to large flows or the crossing blocking.
- Both ends of culverts should have abutments (which can be large rock or poles & timber) installed to protect the fill over the culvert
- Divert runoff from roads and tracks leading to stream crossings to sediment control measures or undisturbed vegetation. Ensure that runoff is never discharged directly into streams, including ephemeral streams.
- Stabilise road and track approaches to the stream crossing with aggregate or other suitable material immediately work is completed.
- Keep a close eye on all crossings, and maintain them in a safe and functional condition.
- Anchor temporary crossings such as bridges.
- Remove temporary crossings such as culverts, portable bridges and other obstructions as soon as crossings are no longer needed

Photo 8.1 Example of a temporary log crossing over an ephemeral gully with a small upper catchment

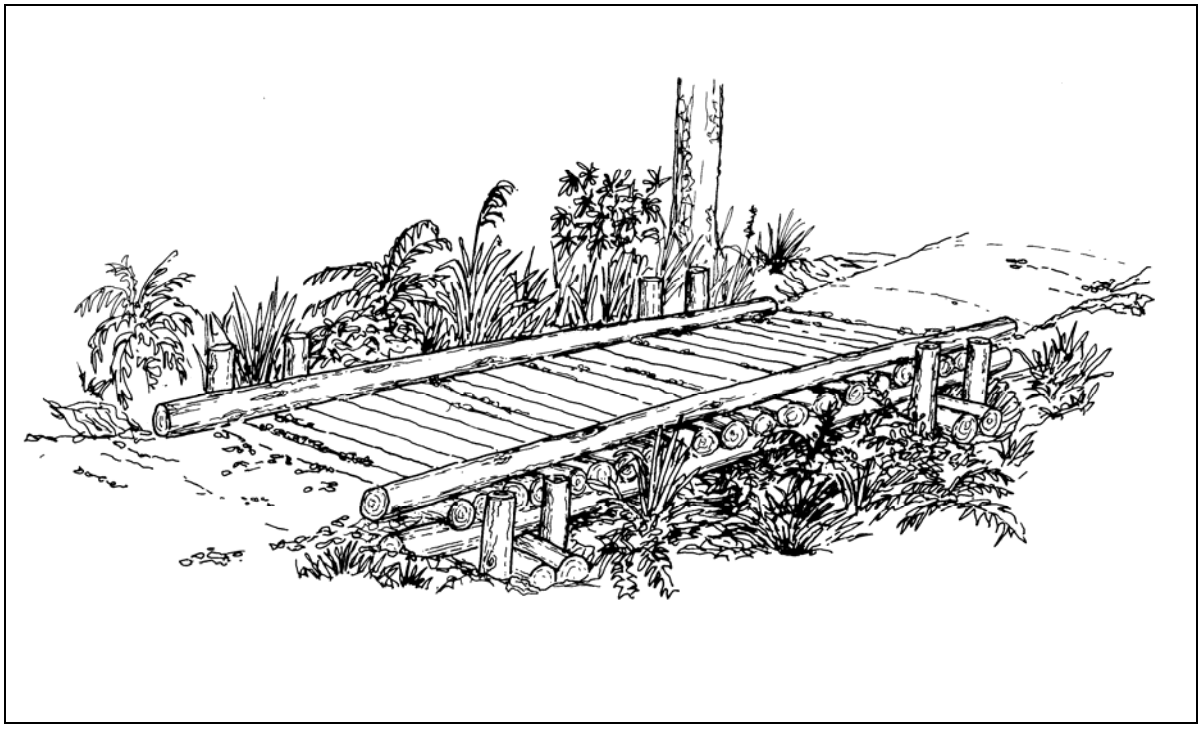


Figure 8.1 Schematic Diagram of Temporary Log Crossing

8.3 Practices

8.3.1 Damming & Pumping or Dam & Divert

Photo 8.2 Metal plate weir used as a temporary dam to divert flows around the working area (Photo: Wood & Partners Ltd)

Description/Purpose

There are several diversion methodologies that will assist in providing dry working conditions for culvert installation. Damming a stream and pumping the flows around the work site back to the stream minimises disturbance considerably compared with that if a new diversion channel is constructed. With high flow streams, diversions are sometimes the only option, however with most small streams, damming and pumping are less harmful to the environment and relatively simple to carry out.

Design

Construct a dam across the stream with stabilised materials such as sand bags, large rock with geo-textile support or other suitable construction materials. Install a pump in the dam and ensure that sufficient hose length is available to reach below the new culvert outlet.

Place the pump inlet in a drum with holes to minimise the possibility of sucking sediment from the bottom of the dam. Make sure that the outlet is to a stabilised area with an energy dissipater such as riprap boulders or similar (thick layer of slash).

Construction Notes:

(a) Make sure that the dam is robust and capable of holding back the incoming flows.

(b) Ensure the pump is capable of conveying the flows as overtopping the dam will cause problems when laying compacted base material for the new culvert.

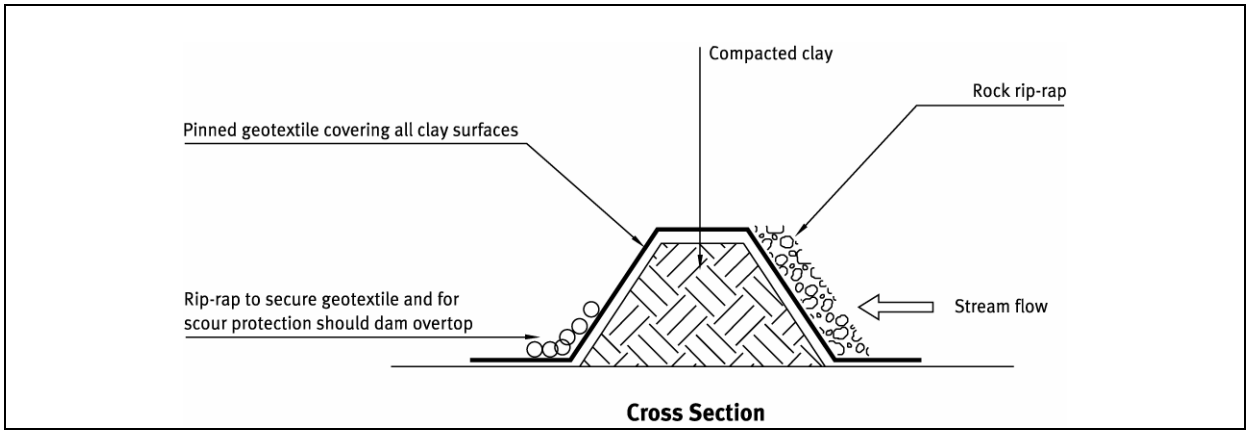


Figure 8.2 Temporary Watercourse Diversion Dam Detail

8.3.2 Temporary Watercourse Diversions

Description/Purpose

A short term watercourse diversion to allow works to occur within the main watercourse channel under dry conditions.

Application

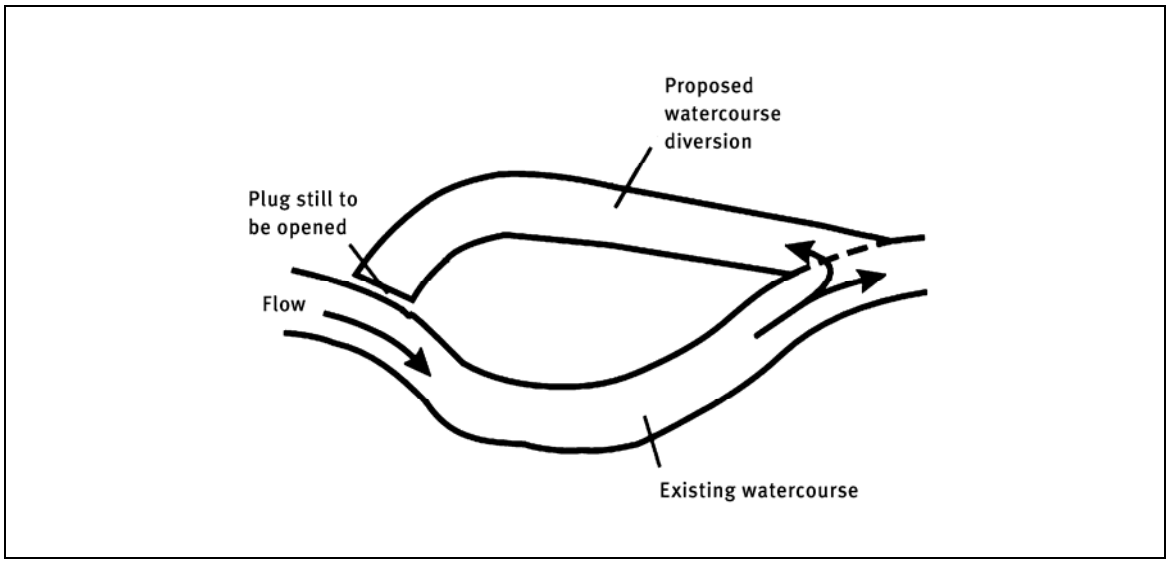
Temporary watercourse diversions are used as temporary measures to allow any works to be undertaken within permanent and ephemeral watercourses. Do not build a watercourse crossing during the fish migration period for the watercourse. The Auckland Regional Council can help identify these periods for particular watercourses.

Design

Divert all flow via a stabilised system (designed to 1:20 year storm event) around the area of works and discharge it back into the channel below the works to avoid scour of the channel bed and banks. Figure 8.3 shows the suggested steps to minimise sediment generation and discharge from works within a watercourse.

Step 1

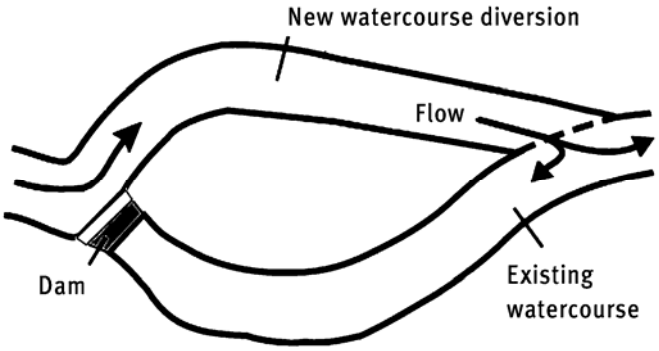
Excavate the diversion channel leaving a plug at each end so that the watercourse does not breach the diversion. Size the diversion channel to allow for a 1:20 year (5% AEP) rain event. Stabilise the diversion channel appropriately to ensure it does not become a source of sediment. Anchor suitable geotextile cloth in place to the manufacturer's within the channel to reduce problems when the upstream plug is excavated. Open the upstream plug and allow water to flow into the channel.



Step 2

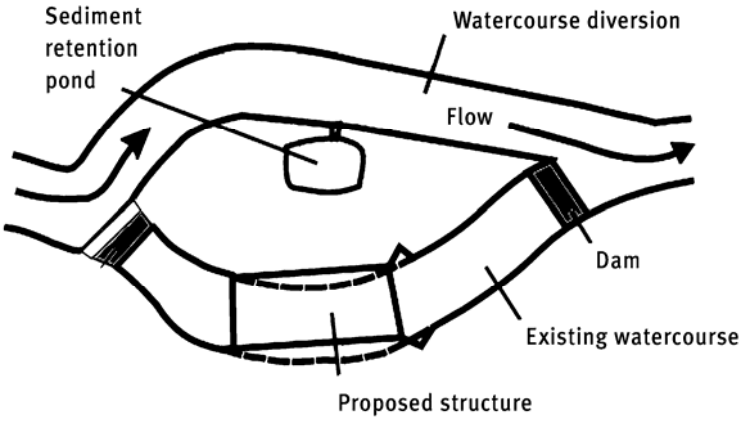
Immediately place a non-erodible dam in the upstream end, with rock rip-rap extending over the upper face and adjacent to the lower face for scour protection. Watercourse. Examples of a metal plate weir to dam the flows is outlined in Plate 8.2 and a dam detail using compacted clay is illustrated in Figure 8.2.

Construct the dam as specified in Step 2 of Figure 8.3,where a compacted earth bund has shotcrete/ concrete placed, or appropriate geotextile pinned over it, with rock rip-rap extending over the upper face and adjacent to the lower face for scour protection.



Step 3

Immediately install a non-erodible downstream dam to prevent backflow into the construction area. Drain the existing watercourse by pumping to a Sediment Retention Pond where treatment of the ponded water can occur prior to re-entering the live section of the watercourse. Construct the structure and complete all channel work.



Step 4

Remove the downstream dam first, allowing water to flood back into the original channel. Remove the upstream dam and fill in both ends of the diversion channel with non-erodible material. Pump any sediment laden water to a Sediment Retention Pond. Fill in the remainder of the diversion and stabilise.

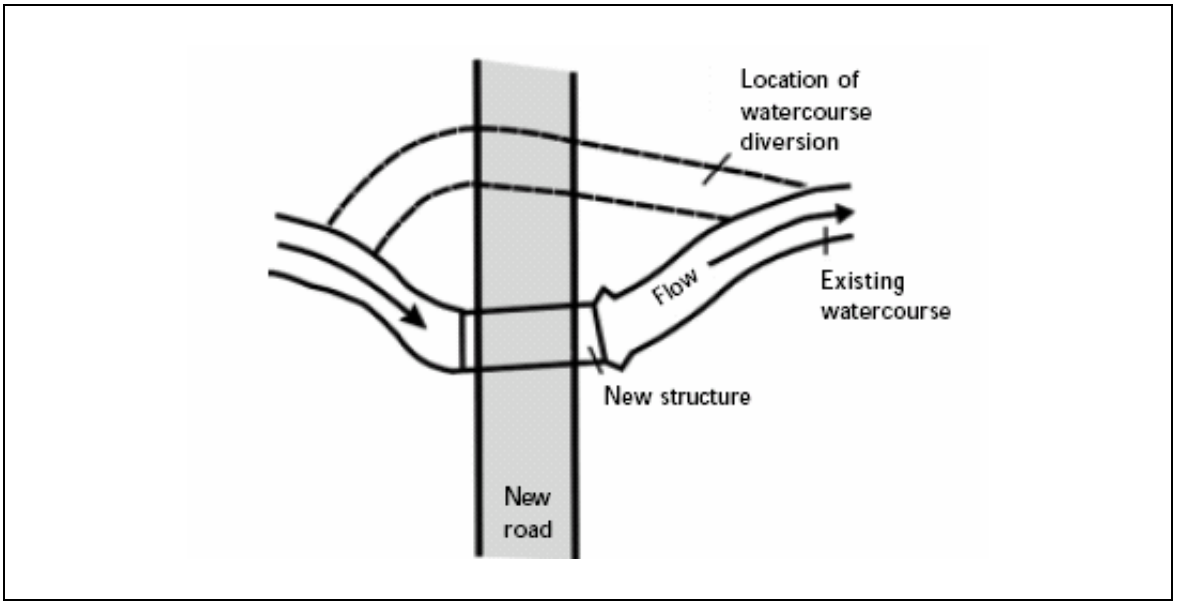


Figure 8.3 Temporary watercourse diversion works sequence

Maintenance

Any works within a watercourse will require ongoing and vigilant maintenance to minimise sediment generation. To achieve this, identify and correct any signs that may indicate a potential problem. Take particular notice of the following signs:

- The geotextile lining ripping
- Scour occurring where the flow re-enters the channel
- Undercutting of the diversion lining
- Make repairs immediately

8.3.3 Culvert Installation

Culvert Sizing

It is important to note that structures within a Category 2 (ephemeral) watercourse do not require a resource consent from the ARC provided certain conditions are met. However, some structures (either permanent or temporary) within Category 1 watercourses may require consent from the ARC. You are advised to check with the ARC before installing these structures.

Culverts should be sized so that they can convey as large a storm as possible. A general culvert sizing guide for the Auckland region is shown in Table 6 below. Specific design should be undertaken for catchments greater than these (ARC TP108 outlines the preferred procedure to calculate runoff volumes in the Auckland region).

Table 8: Culvert Diameters for Specified Catchment Areas[2]

Catchment Area (ha)	Culvert Diameter (mm)
0.5	300
0.9	375
1.5	450
2.2	525
3.2	600
4.4	675
5.8	750
7.5	825
9.5	900

Construction Notes:

- Attention to design detail will minimise the potential for structures to be overwhelmed or outflanked during high rainfall events with resulting structural and or environmental damage.
- Place the structure in line with the natural stream course.
- Culvert pipe sizes should be a minimum of 300 mm diameter to minimise blocking.
- Construct crossings "in the dry" whenever possible (refer Sections 8.2.1 & 8.2.2). This commonly involves a temporary diversion system that should be capable of conveying the flow from a 20 year rainfall event from the above catchment during construction. Diversion systems often involve a diversion bund/wall on either side of the proposed works, with a temporary channel capable of conveying the diverted flow. The upstream and downstream plugs along with the channel need to be stabilised against erosion (e.g. by using sandbags, fabric etc).

[2] Derived from New Zealand Forest Service - Civil Engineering Bulletin 4; August 1980. The table relates to rough hilly country and is based on a rainfall of about 100 mm/hour. If smaller culverts are used, the requirement for an erosion proof secondary flow path becomes more critical.

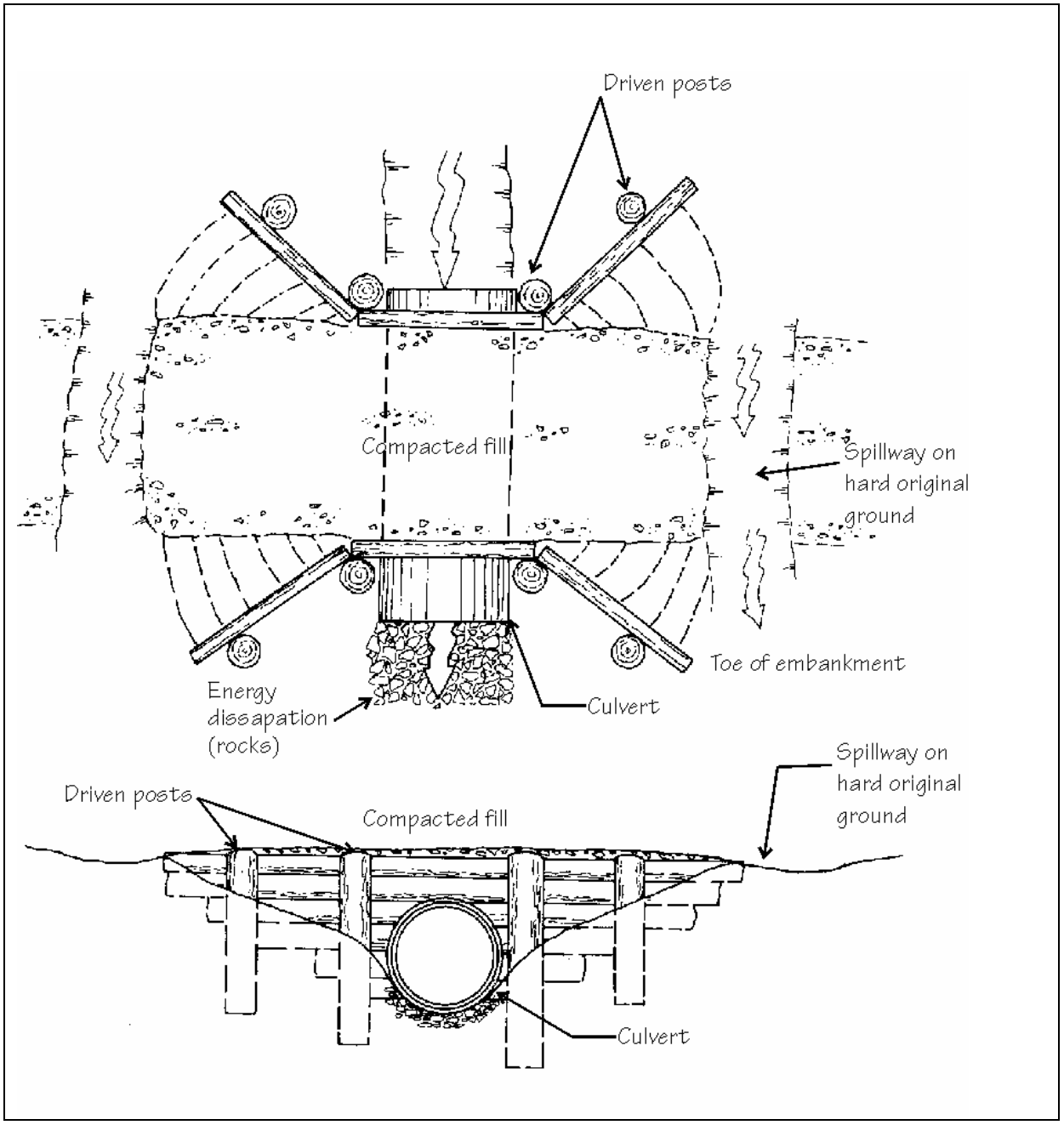


Figure 8.4 Schematic diagram of temporary culvert crossing