



## GUIDELINES FOR THE PROTECTION OF CLASS 4 STREAMS

### INTRODUCTION

Since the Soils and Water Review of Davies et al. (1999) the treatment of Class 4 streams in the forestry estate has been the subject of further research and reviews supported by the Forest Practices Board (now the Forest Practices Authority). Publications include a thesis (Bunce 2000) and subsequent paper by Bunce and co-workers on the effects of pre-Code logging on high-altitude streams in granite terrain (Bunce et al. 2001), a review of actual prescriptions applied by foresters to Class 4 streams (McIntosh 2001), a report on stream risk assessment in northeast Tasmania (Wells 2002) and a new risk classification system (McIntosh and Laffan 2005). The last-mentioned paper includes the scientific justification and reasoning behind these guidelines.

### PRINCIPLE

The new guidelines are based on the principle that the inherent erosion risk in the riparian zone is chiefly dependent on slope and soil erodibility. These two factors determine an 'erosion hazard' class. Each erosion hazard class requires an appropriate level of protection, which may be upgraded if 'erosion features' are noted.

### BASIC OBSERVATIONS REQUIRED

To assess actual and potential risk to a Class 4 stream it is necessary to have the following information about the stream and its riparian zone<sup>1</sup>:

- What is the maximum riparian slope?
- What is the soil erodibility in the riparian zone?
- Are 'erosion features' present?

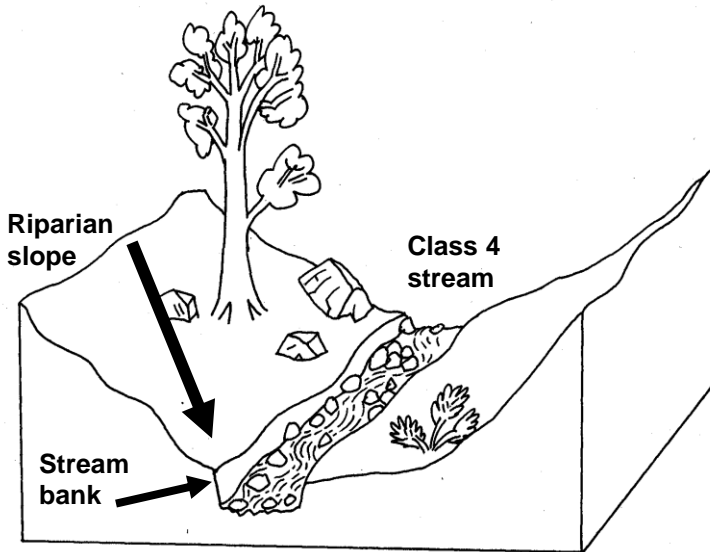
To answer these questions a field inspection will normally be required, but it is unlikely that every stream present will need to be walked over its entire length. The more risky areas of the coupe, e.g. steeper slopes, any areas showing instability, or unusual soils (e.g. aeolian sands) should be inspected, as done at present. The tables in **Step 1** provide an optional recording system which foresters may find useful for determining prescriptions on problematical streams.

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<sup>1</sup> For the purpose of these guidelines, the riparian zone is defined as the 0-10 m zone adjacent to the stream.

## Slope

The maximum slope in the riparian zone (Figure 1) should be estimated or measured with a clinometer. Stream banks are not considered part of the riparian slope. The measured slope should cover a significant area in the riparian zone (e.g. a short slope a few metres long can be considered to be an inclusion, but if the stream flows through a steep-sided gully for 20% of its length the slopes on this gully should be recorded as the 'maximum slopes' for this stream). As a general rule, the measured maximum slope should cover at least 5-10% of the riparian zone, but FPOs should use their judgement to decide which slopes are significant.



**Figure 1.** The maximum riparian slope is the maximum slope in the 0-10 m riparian zone next to the stream. Stream banks (periodically in contact with stream water) are not considered part of the riparian slope.

## Soil erodibility

Soil erodibility should be determined by correlating soils with those described in publications, including 'Forest Soils of Tasmania' (Grant et al. 1995a), Soils Bulletins 1, 2 and 3 (Laffan et al. 1995; Grant et al. 1995b; Hill et al. 1995), and the Forest Soil Fact Sheets ([www.fpa.tas.gov.au](http://www.fpa.tas.gov.au)). Alternatively, soil erodibility may be determined by Laffan's field method (Laffan 2000) or by checking with the Soil and Water Specialist at the Forest Practices Authority.

## Erosion hazard

From the riparian slope and soil erodibility, erosion hazard in the riparian zone is determined from the table in **Step 2**.

## Erosion features (Figure 2)

For streams there are four categories:

- a channel > 4 m wide (**W**);
- recent boulder movement (**R**);
- near-vertical stream banks >1 m high (**V**);
- sediment accumulation (**A**).

In the riparian zone the categories are:

- landslides or slumps (**L**);
- sheet erosion (**S**);
- tunnel gully erosion (**G**).

It is considered that the presence of these features, alone or in combination, indicates that a Class 4 stream and its riparian zone are at greater risk of erosion than a stream and riparian zone without these features.

## WORKING OUT PRESCRIPTIONS

From the determination of erosion hazard, and the record of erosion features, the appropriate prescriptions are worked out from the keys in **Step 3**. There are five prescriptions to choose from (Figure 3). Note that streams may be divided into reaches requiring different prescriptions: for example, a Class 4 stream that requires a 20 m streamside reserve in its upper (eroding) reach may only require a standard machinery exclusion zone in its lower reach.



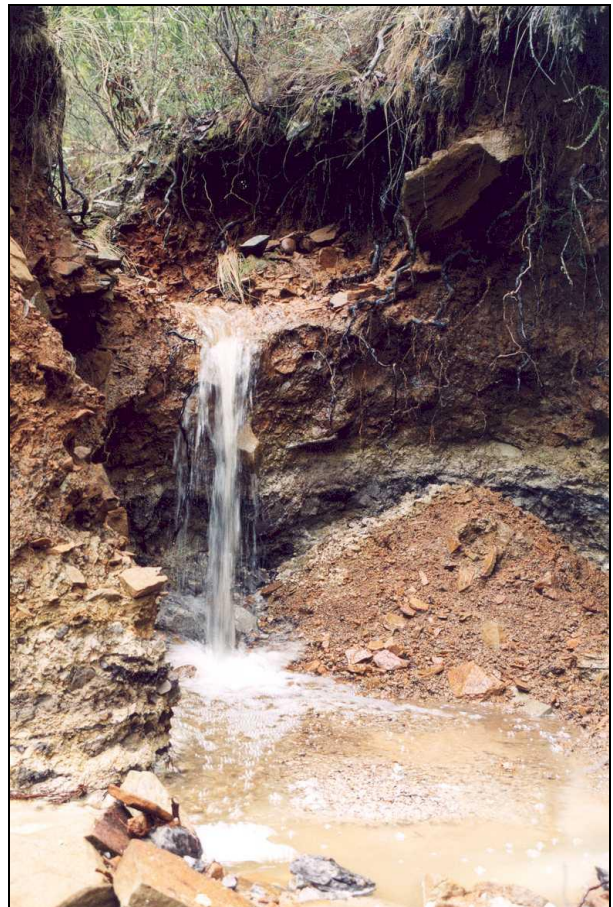
**Figure 2A. A channel >4m wide (W)** is considered to be an 'erosion feature' as it indicates that the stream may flow with considerable force at some time in the year. Meandering slow-moving streams flowing in organic-matter rich sediments in almost flat-bottomed gullies are excepted from the 4 m rule.





**Figure 2B. Recent boulder movement (R).** Where the stream bed contains boulders and these show signs of recent movement (i.e. they are not covered in algae or moss) the stream is designated as having the erosion feature R.

**Figure 2C. Near-vertical stream banks >1 m high (V).** The designation applies to both natural and man-made banks, e.g. those produced by sluicing or artificial deepening on the channel. Banks >1m high are often associated with 'step-pool' stream morphology, as illustrated in this figure.





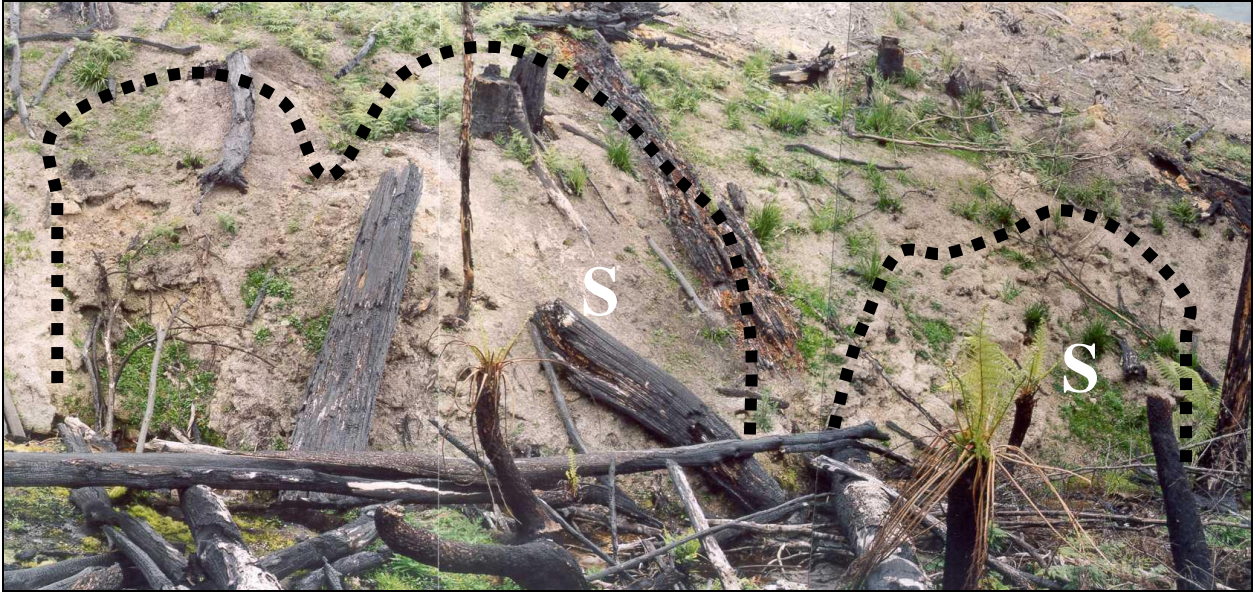


**Figure 2D. Sediment accumulation (A).** The accumulation of erosion products indicates erosion upstream. Here sandy layers intercalated with layers of charcoal indicate periodic erosion and deposition, probably resulting from fires. In sandy or granitic country such erosion and deposition may be indicated by gullies with planar or flat bottoms – augering or digging may reveal buried layers

**Figure 2E. Landslides (L).** A landslide has occurred at the head of this gully in soils derived from Permian rocks. There is also sheet erosion in the left foreground.







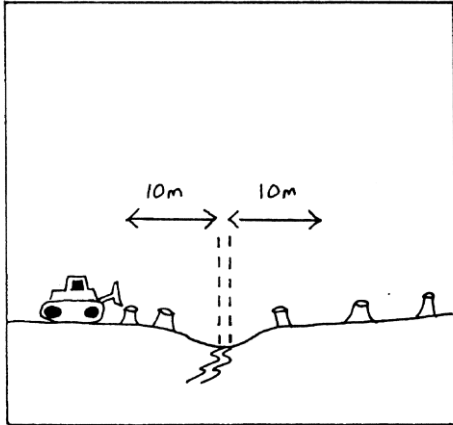
**Figure 2F. Sheet erosion (S).** Sheet erosion (combined with shallow slumps) in the riparian zone of a stream in Mathinna Beds terrain.



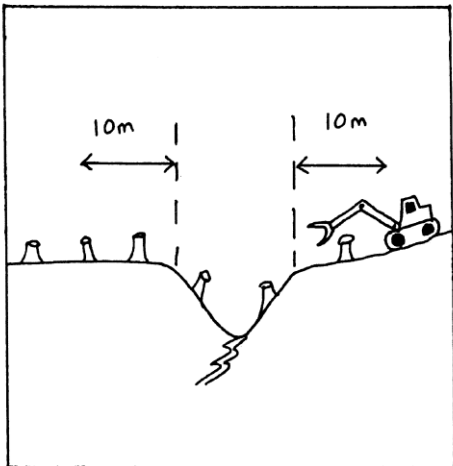
**Figure 2F. Tunnel-gully erosion (G).** Collapse of subsurface drainage channels causes the erosion feature called tunnel gully erosion. Such erosion usually occurs in sandy or silty soils that have moderate to high, high or very high erodibility.

(Subsurface drainage channels also occur in low erodibility soils such as those formed in basalt or dolerite, but the channels are generally stable and do not collapse to form steep-sided gullies, and for this reason subsurface drainage in dolerite and basalt terrain is generally not classified as tunnel-gully erosion.)

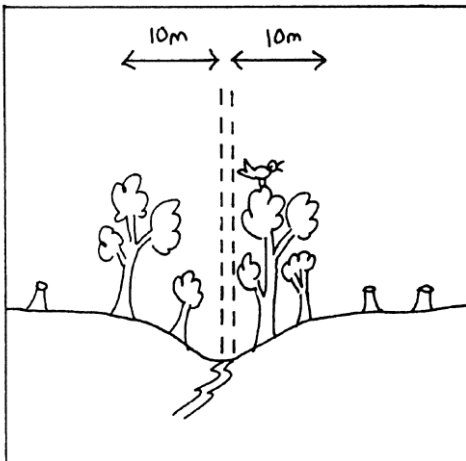
**Figure 3.** Prescriptions to be applied to Class 4 streams.



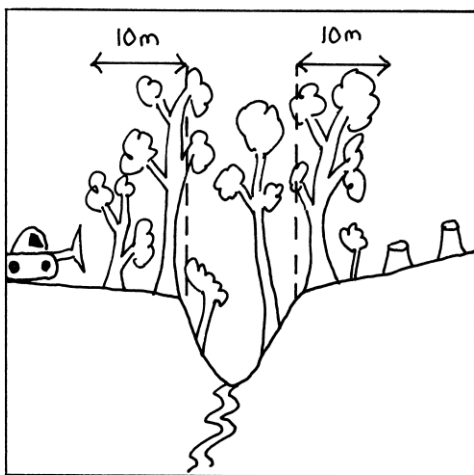
**Figure 3.1.** Standard Class 4 Machinery Exclusion Zone (MEZ) as defined in the Forest Practices Code (2000).



**Figure 3.2.** Extended Class 4 Machinery Exclusion Zone (MEZ). The 10 m wide zone is measured from where the steep ( $>19^\circ$ ) gully sides begin. The maximum width is 20 m.

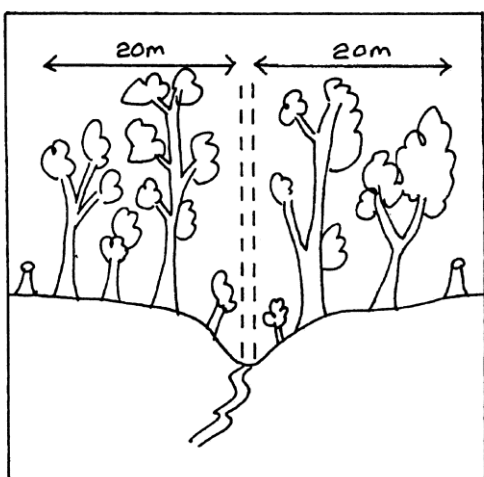


**Figure 3.3.** Class 4 Streamside Reserve (SSR). A 10 m no-machinery and no-harvest zone is applied.



: protection of class 4 streams

**Figure 3.4.** Extended Class 4 Streamside Reserve (SSR). The 10 m wide SSR is measured from where the steep ( $>19^\circ$ ) gully sides begin (commonly referred to as 'the break in slope'). The maximum streamside reserve width from the stream bank is 20 m.



**Figure 3.5.** A 20 m Streamside Reserve (SSR) is applied to the Class 4 stream.



**STEP 1.** Record stream characteristics  
(Circle options selected.)

<b>Coupe No.:</b>	
<b>Class 4 stream I.D.</b>	
<b>Steepest riparian slopes</b> (must cover at least 5 – 10% of riparian zone)	<b>deg</b>
<b>Soil erodibility</b>	<b>Low Mod. Mod. to high High Very High</b>
<b>EROSION HAZARD CLASS</b> (from Step 2)	<b>A B C D E</b>
<b>EROSION FEATURES</b>	
<b>Channel &gt;4 m wide</b>	<b>W</b>
<b>Recent boulder movement</b>	<b>R</b>
<b>Near-vertical stream banks &gt;1m high</b>	<b>V</b>
<b>Sediment accumulation</b>	<b>A</b>
<b>Landslides or slumps</b>	<b>L</b>
<b>Sheet erosion</b>	<b>S</b>
<b>Tunnel-gully erosion</b>	<b>G</b>
<b>No erosion features</b>	<b>NIL</b>
<b>PRESCRIPTION</b> (from Step 3)	

<b>Coupe No.:</b>	
<b>Class 4 stream I.D.</b>	
<b>Steepest riparian slopes</b> (must cover at least 5 – 10% of riparian zone)	<b>deg</b>
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<b>Steepest riparian slopes</b> (must cover at least 5 – 10% of riparian zone)	<b>deg</b>
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<b>EROSION FEATURES</b>	
<b>Channel &gt;4 m wide</b>	<b>W</b>
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<b>Sheet erosion</b>	<b>S</b>
<b>Tunnel-gully erosion</b>	<b>G</b>
<b>No erosion features</b>	<b>NIL</b>
<b>PRESCRIPTION</b> (from Step 3)	

**STEP 2.** Work out Erosion Hazard Class in the riparian zone (0–10 m).

**Erosion hazard in relation to soil erodibility class and slope angle.**

A = low erosion hazard;

B = moderate erosion hazard;

C = moderate to high erosion hazard;

D = high erosion hazard;

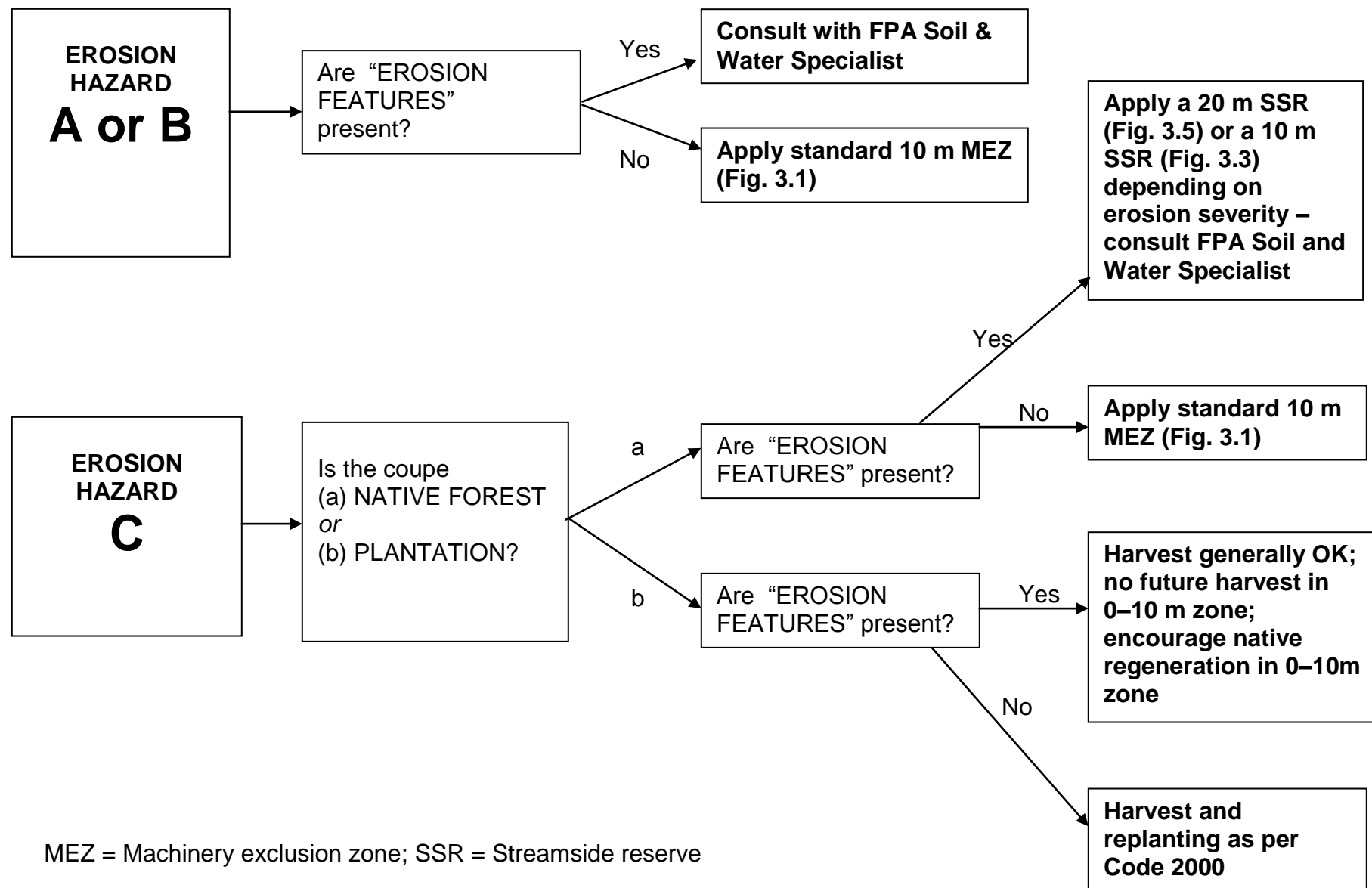
E = very high erosion hazard.

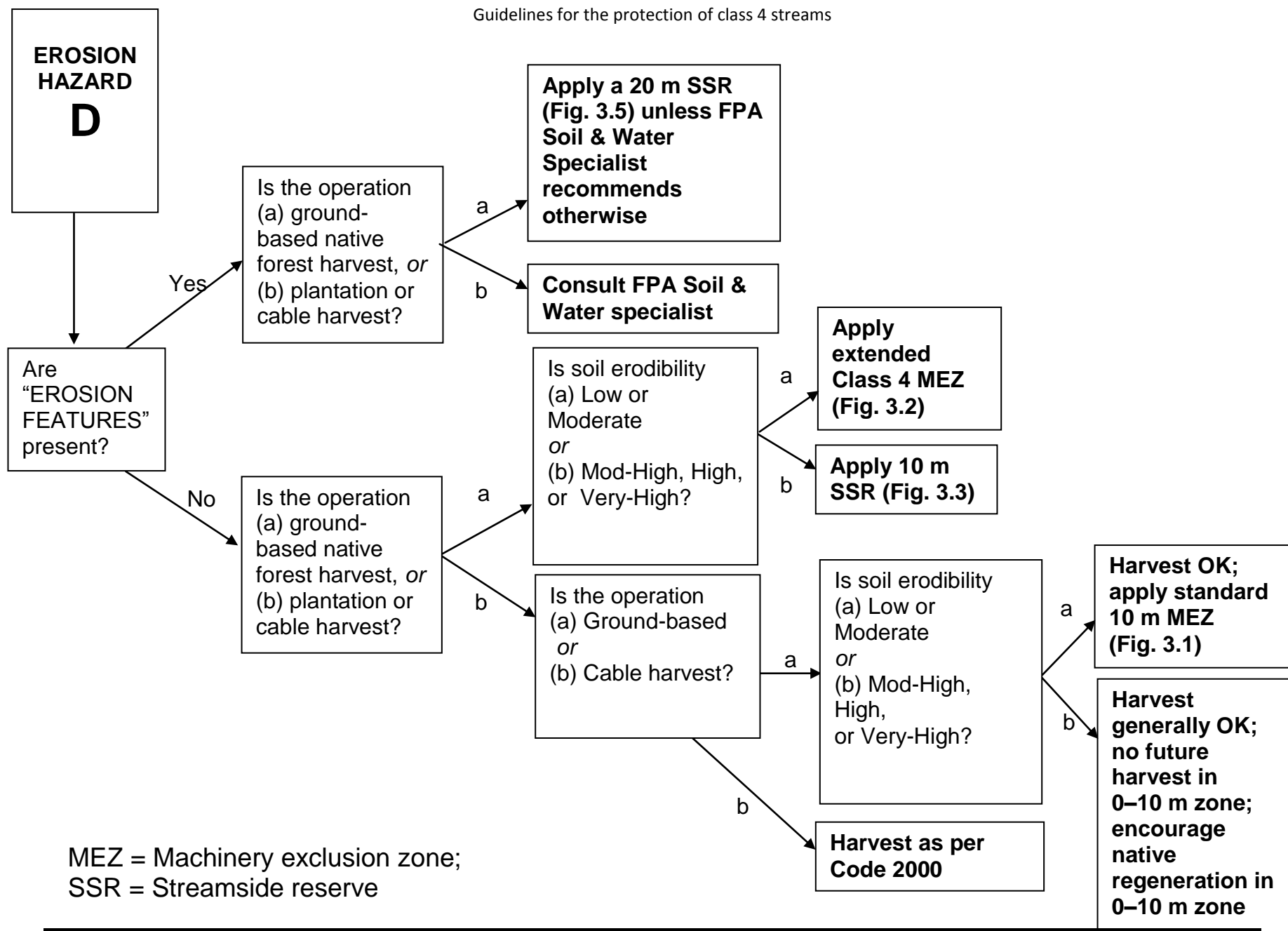
Maximum slope in riparian zone*	Soil Erodibility Class				
	Low	Moderate	Moderate - High	High	Very High
<3°	A	A	A	C	C
3 - 8°	B	B	B	C	D
9 - 11°	B	B	C	C	D
12 - 14°	B	C	C	D	E
15 - 19°	C	C	D	E	E
20 - 26°	D	D	E	E	E
>26°	D	E	E	E	E

\*Stream banks themselves are not included. Slopes must cover a significant area, e.g. at least 5-10% of the riparian zone (0-10 m).

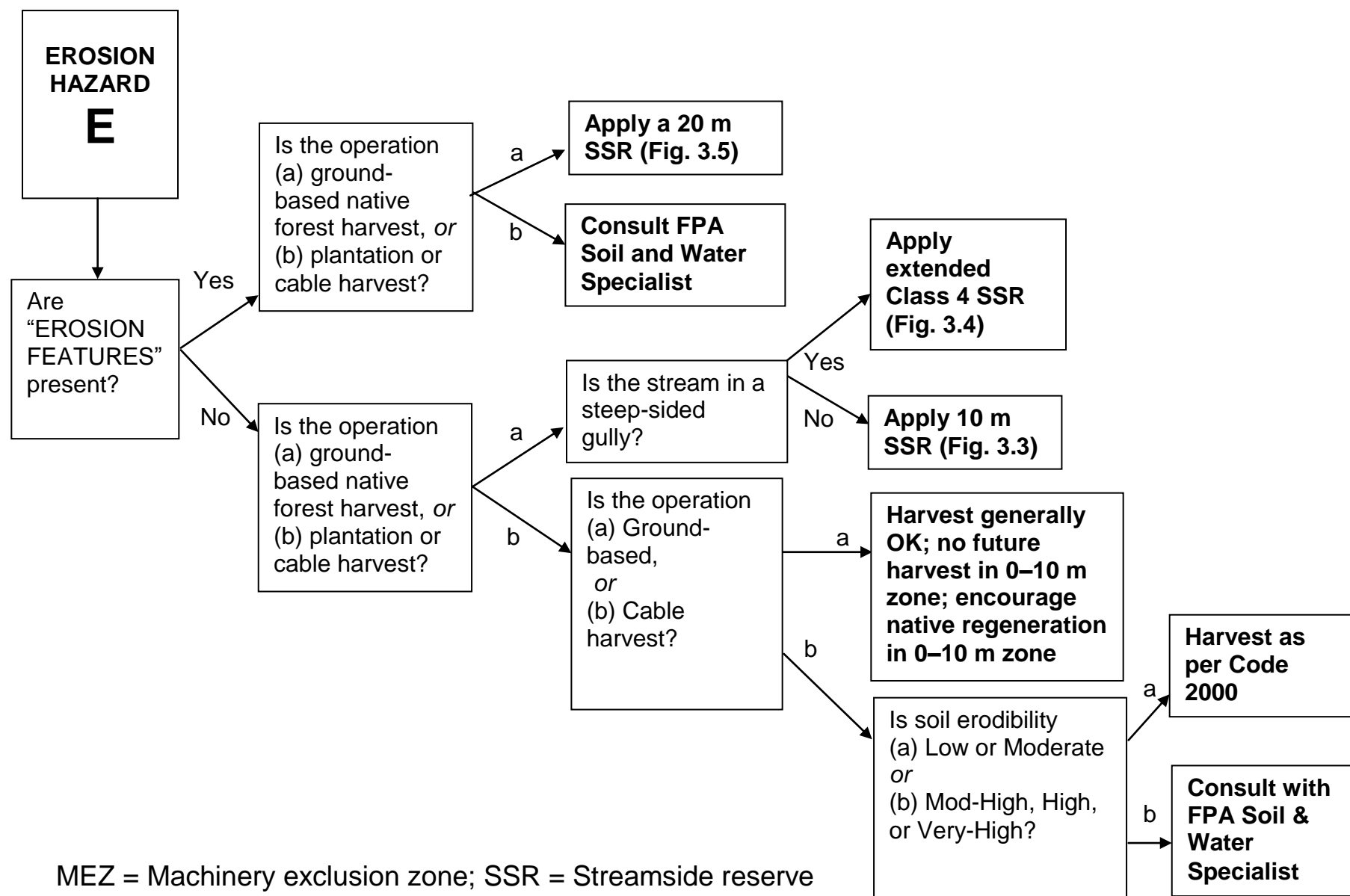


**STEP 3.** Starting from the erosion hazard classification, key out a prescription.









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