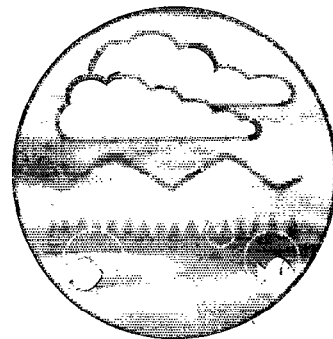
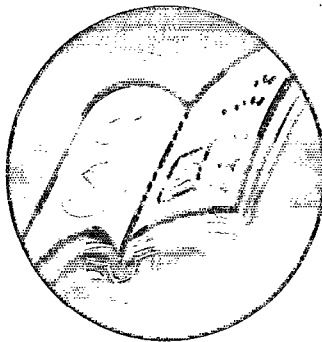
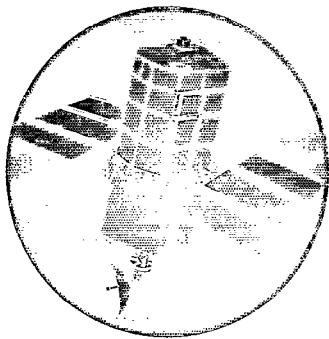


Environmental Guidelines for Vegetation Management in Channel and on Banks



Research and Development
Technical Report
W135



ENVIRONMENT AGENCY



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Environmental Guidelines for Vegetation Maintenance in Channel and on Banks

Technical Report W135

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Statement of use

This document contains environmental guidelines for river channel and bank vegetation management. They are designed to facilitate the selection of vegetation management practices which enhance environmental quality. They should be used in conjunction with the Guidelines for the Justification of River Maintenance.

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Amendments

Any corrections or proposed amendments to this manual should be made through the regional Agency representative on the Water Resources National Abstraction Licensing Group.

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ENVIRONMENTAL GUIDELINES FOR VEGETATION MAINTENANCE IN CHANNEL AND ON BANKS

INTRODUCTION

These Guidelines are designed to assist Flood Defence staff to determine the most environmentally suitable method of vegetation maintenance. They should be used in conjunction with the Guidelines for the Justification of River Maintenance. The Guidelines do not include background rationale or the ecological principles underlying their development which have been set out in the background document (R&D 536/1/ST). These Guidelines were originally issued as R&D Note 511 in 1996 and were subsequently tested by Flood Defence, Conservation and Fisheries staff from each Region of the Environment Agency.

These Guidelines cover two aspects of routine maintenance - those in the channel and on banks. The Channel Guidelines cover plants in the wetted area of the channel. Those for the banks cover land above the wetted area, excluding flood banks, and do not include options for management of woody vegetation. This has been excluded as it is not a routine management activity.

The decision tree below charts the recommended step-by-step process for determining the extent and type of channel or bank management which is 'Best', 'Good' or 'Acceptable' practice. A detailed flow chart of the method is given on page 3 but a summary of the process is as follows:

1. Identify possible operational practice for the river or bank type.
2. Either: (a) implement the most suitable Good or Best Practice or, if this is not possible,
(b) determine channel or bank wildlife quality.
3. Depending on the quality of the site, either (a) implement Acceptable practice or, if this is not possible,
(b) consult with FER regarding the acceptability of other practices.

Where more than one option ranks equally (ie two practices are operationally appropriate and rank the same in conservation terms) then the one which involves a smaller proportion of the river or bank being managed or one which extends the timescale between operations should be chosen.

The Guidelines do not include a 'do-nothing' option as they take as the starting point that there has been an identified need for vegetation management. There may however be situations where management is not required for Flood Defence reasons but some management may be required to maintain the conservation interest. FER should therefore be informed of any proposal to discontinue management.

There will be occasions where the river in question will have specific ecological interest which cannot be detected using the Guidelines. For this reason FER should notify FD of any river that contains important species, such as otters, water voles or migratory salmonids, or is designated as a wildlife site of any description, eg Site of

Special Scientific Interest or County Wildlife Site, in advance of any possible changes to a maintenance regime. Consultations may need to be maintained.

It is not the function of these Guidelines to dictate contracting and implementation arrangements. Internal Guidelines should be followed to help in these matters. Examples include 'Requirements for Watercourse Maintenance Works' produced by Thames Region 1997, 'Grass cutting and Aquatic Weedcutting Service Level Agreement' produced by North Wessex-Somerset Area of the Southwest Region and 'Specifications for Flood Defence Maintenance Works' produced by Anglian Region in 1997. Additionally the Environment Agency has produced best practice guidelines on Aquatic Weed Control Operation (R&D Note 395). However, to assist, Appendices 1 and 2 contain photographs which illustrate good and bad working practice for wildlife in channel and on banks.

METHOD

To identify the best practice for either Channel or Bank vegetation management

- A. Determine Channel category (see Stage 1 page 4) or Bank category (see Stage 3 page 10) as appropriate *Go to B*
- B. Determine Best or Good Practice for Channel (see Stage 2 page 5) or Bank (see Stage 4 page 12) management
- | | | |
|-------------------------------------------|--------|----------------|
| Can Best or Good Practice be implemented? | a. Yes | <i>Go to G</i> |
| | b. No | <i>Go to C</i> |
- C. Determine Channel (see Stage 5 page 15) or Bank (Stage 6 page 22) wildlife quality
- | | |
|-------------|----------------|
| a. High | <i>Go to E</i> |
| b. Not high | <i>Go to D</i> |
- D. Determine the wildlife quality of adjacent land (Stage 7 page 26)
- | | |
|-------------|----------------|
| a. High | <i>Go to E</i> |
| b. Not high | <i>Go to F</i> |
- E. If either river (channel or bank as appropriate) or adjacent land wildlife quality is High, and Best or Good Practice cannot be implemented, continue with existing practice* and consult with FER**. Document agreed action.
- F. If wildlife quality is not High for either river (channel or bank as appropriate) or adjacent land can Acceptable Practice be implemented?
- | | |
|--------|----------------|
| a. Yes | <i>Go to G</i> |
| b. No | <i>Go to H</i> |
- G. Implement the desired practice and document it so it may be followed in future.
- H. Discuss with FER whether Poor Practice can be used. Document the agreed procedures.

*Existing practice is defined as having been regularly used in the past five years and being expected to continue into the future. It should be documented so that it is not inadvertently changed.

**Immediate modification of practice may not be possible, but lengths should be identified and a timetable agreed for reconsidering approaches to vegetation control

STAGE 1 DETERMINE CHANNEL CATEGORY

From the gradient and average bed width of the channel over the reach under consideration identify the river category.

WIDTH (m)	GRADIENT	CATEGORY
< 2	Steeper than 1:1500	1
< 2	Less steep than 1:1500	2
2 - < 5	Steeper than 1:1500	3
2 - < 5	Less steep than 1:1500	4
5 - < 10	Steeper than 1:1500	5
5 - < 10	Less steep than 1:1500	6
10 +	Steeper than 1:1500	7
10 +	Less steep than 1:1500	8

steeper than 1:1500 = > 0.07 %

less steep than 1:1500 = < 0.07 %

STAGE 2 DETERMINE BEST PRACTICE FOR CHANNEL MAINTENANCE

Use the following tables to evaluate the proposed management. Two tables are provided within this section. The first relates to the management of emergent vegetation (those plants which rise above the water and which may be in the centre or on the margins of the wetted channel). The second relates to the submerged vegetation.

To evaluate the practice:

1. Use the relevant table to identify the acceptability of the practice currently used.
2. If existing operational practice is Best or Good Practice (see below), continue with this or adopt an even more sensitive approach if practicable.
3. If existing operational practice or none of the practices that you could use is Best or Good, then identify the wildlife quality of the reach (Stages 5, page 15, and 7, page 26). Refer to the method on page 3 for guidance on whether an Acceptable Practice can be adopted or whether consultation with FER is required.

If both emergent and submerged/floating vegetation occur and are to be managed as one operation, then use both tables and identify which is the most acceptable practice.

When management of narrow (<2m wide) steep-sided watercourses is undertaken, bank management may be required as an integral part of the work. If this is the case then the Guidelines for bank management should also be consulted to find the most acceptable practice.

Key to the tables:

U	Unacceptable Practice – unlikely to be acceptable except under exceptional circumstances which should have been agreed by FER.
P	Poor Practice – FER agreement and site-specific prescription required for implementation.
A	Acceptable Practice – FER agreement required for rivers of high wildlife quality (see section 5).
G	Good Practice – implement for any river unless a best practice option can be chosen.
B	Best Practice – implement for any river.

NB:

1. References to percentages in the table refer to the percentage of the total channel along the operational reach that has vegetation removed.
2. Where a rotation for management is given e.g. 2 - 5 years, then on the longer cycles (5+ years) whole channel management will be acceptable though not desirable. On shorter rotations (2/3 years) it will not be acceptable and only Best practice should be used.
3. Cutting assumes that the whole reach length is cut as required. However, desilting and herbicide use assume that only a proportion of the reach is managed with no more than 30% of a river system being managed in any one year.
4. No regime that has a longer management timescale than 7 years is considered. This is because longer periods between management stop an operation being routine maintenance and become a one-off management operation.

Table 1: Emergent Vegetation

Option	Channel Category							
	1	2	3	4	5	6	7	8
<i>Annual cutting – spring or summer</i>								
Whole channel clear	P	P	P	P	U	U	U	U
90 % + clear	P	P	P	P	P	P	U	U
60 - 90 % clear	P	P	P	P	A	A	A	A
30 - 60 % clear	A	A	A	A	A	A	A	A
10 - 30 % clear	A	A	A	A	G	G	G	G
Selective clearance (< 10 %)	A	A	G	G	G	G	G	G
<i>Annual cutting – autumn or desilting/raking - autumn</i>								
Whole channel clear	P	P	P	P	U	U	U	U
90 % + clear	P	P	P	P	P	P	U	U
60 - 90 % clear	A	A	A	A	A	A	A	A
30 - 60 % clear	A	A	G	G	G	G	G	G
10 - 30 % clear	G	G	G	G	G	G	G	G
Selective clearance (< 10 %)	B	G	G	G	G	B	G	B
<i>Multiple annual cutting spring/summer with autumn</i>								
Whole channel clear	P	P	P	P	U	U	U	U
90 % clear	P	P	P	P	P	P	U	U
60 - 90 % clear	P	P	P	P	P	P	P	P
30 - 60 % clear	A	P	A	P	A	A	A	A
10 - 30 % clear	A	A	A	A	A	G	G	G
Selective clearance (< 10 %)	A	A	G	G	G	G	G	G
<i>Multiple annual cutting summer and autumn</i>								
Whole channel clear	P	P	P	P	U	U	U	U
90 % + clear	P	P	P	P	P	P	U	U
60 - 90 % clear	P	P	P	P	A	P	A	P
30 - 60 % clear	A	A	A	A	A	A	G	G
10 - 30 % clear	A	A	G	G	G	G	G	G
Selective clearance (< 10 %)	G	G	G	G	G	G	G	G
<i>Biennial cutting</i>								
Whole channel clear	P	P	P	P	P	P	P	P
90 % + clear	P	P	P	P	A	A	A	A
60 - 90 % clear	A	A	A	G	G	G	G	G
30 - 60 % clear	G	G	G	G	G	G	G	G
10 - 30 % clear	G	G	G	G	G	G	G	G
Selective clearance (< 10 %)	B	B	B	B	B	B	B	B

Table 1: Emergent Vegetation cont:

Option	Channel Category							
	1	2	3	4	5	6	7	8
<i>Cutting 3-5 year rotation</i>								
Whole channel clear	P	P	P	P	P	P	P	P
90%+ channel clear	A	A	A	A	A	A	A	A
60 - 90 % clear	A	A	A	A	G	G	G	G
30 - 60 % clear	G	G	G	G	G	G	G	G
10 - 30 % clear	G	G	G	G	G	G	G	G
Selective clearance (< 10 %)	B	B	B	B	B	B	B	B
<i>Desilting/ raking on a 2 - 7 year cycle</i>								
Whole channel clear	P	P	P	P	P	A	P	A
90 % + clear	P	A	P	A	P	A	A	A
60 - 90 % clear	A	A	A	A	A	A	A	A
30 - 60 % clear	A	G	G	G	G	G	G	G
10 - 30 % clear	G	G	G	G	G	G	G	G
Selective clearance (< 10 %)	G	B	B	B	B	B	B	G
<i>One-off Herbicide application at a suitable time</i>								
Whole channel clear	U	U	U	U	U	U	U	U
90 % + clear	U	U	U	U	U	U	U	U
60 - 90 % clear	P	P	P	P	P	P	P	P
30 - 60 % clear	P	P	A	P	A	A	A	A
10 - 30 % clear	A	A	A	A	G	G	G	G
Selective clearance (< 10 %)	G	G	G	G	G	G	G	G

Table 2: Submerged/ Floating Vegetation

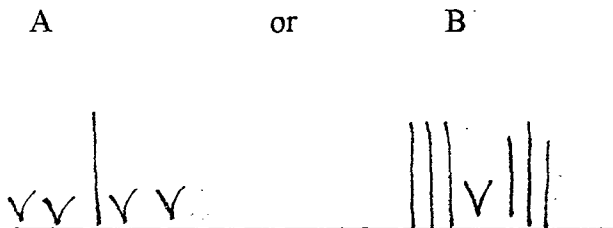
Option	Channel Category							
	1	2	3	4	5	6	7	8
<i>Annual cutting – spring/ summer</i>								
Whole channel clear	P	P	P	P	U	U	U	U
90 % + clear	P	P	P	P	P	P	U	U
60 - 90 % clear	P	P	P	P	A	A	A	A
30 - 60 % clear	A	A	A	A	A	A	G	G
10 - 30 % clear	G	G	G	G	G	G	G	G
Selective clearance (< 10 %)	G	G	G	G	G	G	G	G
<i>Annual cutting – autumn or desilting/raking - autumn</i>								
Whole channel clear	P	P	P	P	U	U	U	U
90 % + clear	P	P	P	P	P	P	U	U
60 - 90 % clear	A	A	A	A	A	A	A	A
30 - 60 % clear	A	A	G	G	G	G	G	G
10 - 30 % clear	G	G	G	G	G	G	G	G
Selective clearance (< 10 %)	G	G	G	B	B	B	B	B
<i>Multiple annual cutting spring with either summer or autumn</i>								
Whole channel clear	P	P	P	P	U	U	U	U
90 % + clear	P	P	P	P	P	P	P	P
60 - 90 % clear	P	P	P	P	P	P	A	A
30 - 60 % clear	A	A	A	A	A	A	A	A
10 - 30 % clear	A	A	A	G	A	G	G	G
Selective clearance (< 10 %)	A	A	G	G	G	G	G	G
<i>Multiple annual cutting summer and autumn</i>								
Whole channel clear	P	P	P	P	P	P	P	P
90 % + clear	P	P	P	P	P	P	P	P
60 - 90 % clear	A	A	A	A	A	A	A	A
30 - 60 % clear	A	A	A	A	A	A	A	A
10 - 30 % clear	G	G	G	G	G	G	G	G
Selective clearance (< 10 %)	G	G	G	G	G	B	B	B
<i>Biennial cutting</i>								
Whole channel clear	P	P	P	P	P	P	P	P
90 % + clear	P	P	P	P	A	A	A	A
60 - 90 % clear	A	A	G	G	G	G	G	G
30 - 60 % clear	G	G	G	G	G	G	G	G
10 - 30 % clear	G	B	G	G	G	G	G	G
Selective clearance (< 10 %)	B	B	B	B	B	B	B	B

Table 2: Submerged/ Floating Vegetation Cont:

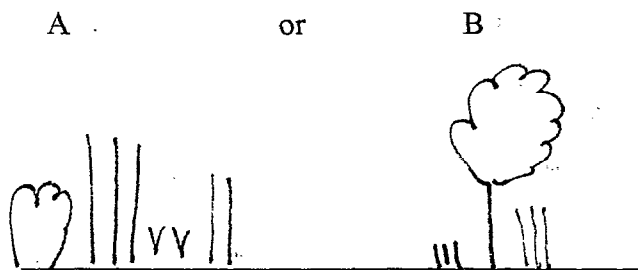
Option	Channel Category							
	1	2	3	4	5	6	7	8
<i>Cutting - 3 - 5 year rotation</i>								
Whole channel clear	P	P	P	P	P	P	P	P
90 % + clear	A	A	A	A	A	A	A	A
60 - 90 % clear	A	G	G	G	G	G	G	G
30 - 60 % clear	G	G	G	G	G	G	G	G
10 - 30 % clear	G	B	G	G	G	G	G	G
Selective clearance (< 10 %)	B	B	B	B	B	B	B	B
<i>Desilting/ raking on a 2 - 7 year cycle</i>								
Whole channel clear	P	P	P	P	P	P	P	P
90 % + clear	P	P	P	P	A	A	A	A
60 - 90 % clear	A	A	A	A	A	A	G	G
30 - 60 % clear	A	A	G	G	G	G	G	G
10 - 30 % clear	G	G	G	G	G	G	G	G
Selective clearance (< 10 %)	B	G	B	G	G	B	G	G
<i>Herbicide application at a suitable time</i>								
Whole channel clear	U	U	U	U	U	U	U	U
90 % + clear	U	U	U	U	U	U	U	U
60 - 90 % clear	P	P	P	P	A	A	A	A
30 - 60 % clear	P	P	A	A	A	A	A	A
10 - 30 % clear	A	A	A	A	A	A	A	G
Selective clearance (< 10 %)	G	G	G	G	G	G	G	G

STAGE 3 DETERMINE BANK CATEGORY

1. Identify the predominant vegetation structures in the reach to be managed along each river bank from the diagrams below and the photographs on the following pages. It is important to differentiate between them to ensure that different types are optimally managed.



Uniform
(predominantly one vegetation type, lacking trees or scrub)



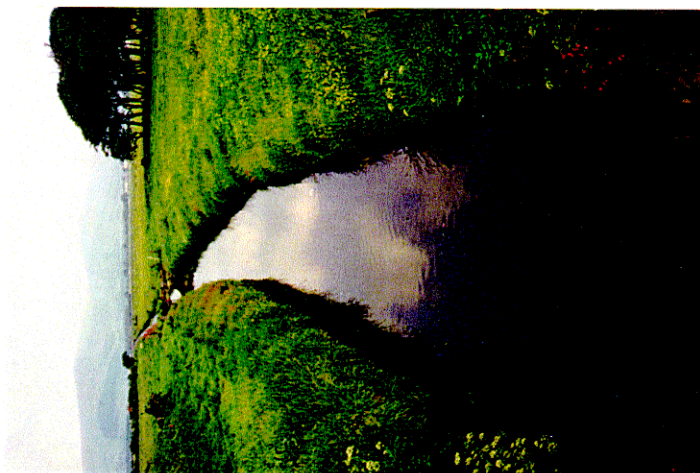
Simple (predominantly 2-3 vegetation types with or without trees or scrub - e.g. trees with a short grass understorey)

2. Identify the bank category from the bed width of the river and the vegetation structure on the banks.

BED WIDTH (m)	VEGETATION STRUCTURE	CATEGORY
< 2	Uniform	A
< 2	Simple	B
2 - < 5	Uniform	C
2 - < 5	Simple	D
5 - < 10	Uniform	E
5 - < 10	Simple	F
10 +	Uniform	G
10 +	Simple	H

Uniform Banks

Left: Dysynni Low Level Drain
Below: R.Roding showing
uniform banks except where
trees are present where the
vegetation structure becomes
simple



Simple Banks



Above: River Stour; Below: Bow Brook
Both rivers show different forms of simple vegetation structure on the banks



STAGE 4 DETERMINE BEST PRACTICE FOR BANK MAINTENANCE

Use the following tables to evaluate the proposed management. Two tables are provided within this section. The first relates to the management of uniform vegetation. Floodbanks are excluded because of their special management needs. The second relates to simple vegetation structures on banks.

Banks with complex vegetation (4 or more vegetation types which will include woody vegetation such as scrub and trees) are not included in these Guidelines. For this vegetation structure to be present, management will be on a longer rotation than seven years or only patch management and so is not considered to be a routine activity. Regional or Area guidelines on the management of woody vegetation should be consulted and occasional selective management may be necessary.

To evaluate the practice:

1. Use the relevant table to identify the acceptability of the practice currently used.
2. If existing operational practice is Best or Good Practice (see below), continue with this or adopt an even more sensitive approach if practicable.
3. If existing operational practice or none of the practices that you could use is Best or Good, then identify the wildlife quality of the reach (Stages 6, page 22, and 7, page 26). Refer to the method on page 3 for guidance on whether an Acceptable Practice can be adopted or whether consultation with FER is required.

If uniform and simple types of vegetation are both present in discrete lengths then Best Practice should be identified for each type. In summary, it is generally best to work on one bank only and undertake selective cutting. Wherever possible, toe strips should be left, the wider the better on both sides. Autumn/winter cutting is better than cutting in spring/summer.

When management of narrow (<2m wide), steep-sided watercourses is undertaken, bank management may be required as an integral part of channel management. If this is the case then the Guidelines for channel management should also be consulted to find the most acceptable practice.

Management of invasive plants is not covered by these Guidelines (see R&D Note 233).

Key to the tables:

U	Unacceptable Practice – unlikely to be acceptable except under exceptional circumstances which should have been agreed by FER.
P	Poor Practice – FER agreement and site-specific prescription required for implementation.
A	Acceptable Practice – FER agreement required for rivers of high wildlife quality (see Section 6).
G	Good Practice – implement for any river unless a best practice option can be chosen.
B	Best Practice– implement for any river.

Table 1: For rivers with uniform banks (excluding floodbanks)

Management Option	Bank category			
	A (<2)	C (2-5)	E (5-10)	G (10 +)
<i>Bank Mowing/Flailing more than twice per year</i>				
Whole bank cut - both sides	P	P	U	U
Whole bank cut - one side	P	A	A	A
Toe strip left -0.25 m wide	P	A	A	A
Toe strip left -0.25 - 1.0 m	A	A	A	A
Toe strip left - 1 m +	A	A	B	B
Top strip left -0.25 m wide	P	P	A	A
Top strip left - 0.25 - 1.0 m	P	P	A	A
Top strip left - 1 m +	P	A	A	A
Selective cutting (< 20 %)	A	A	B	B
<i>Bank Mowing/Flailing twice per year</i>				
Whole bank cut - both sides	P	P	U	U
Whole bank cut - one side	P	A	A	A
Toe strip left -0.2 5m wide	P	A	P	A
Toe strip left -0.25 - 1.0 m	A	A	A	A
Toe strip left - 1 m +	A	A	B	B
Top strip left - 0.25 m wide	P	P	P	P
Top strip left -0.25 - 1.0 m	P	P	A	A
Top strip left - 1 m +	P	A	A	A
Selective cutting (< 20 %)	A	A	A	B
<i>Grazing</i>				
Heavy	P	P	P	P
Light with topping in autumn	B	B	B	B
Light	B	B	B	B
<i>Herbicide Use</i>				
Spot treatment	A	A	A	A
More than spot treatment	U	U	U	U

Table 2: For simple vegetation structure

Management Option	Bank Category			
	B (<2)	D (2-5)	F (5-10)	H (10+)
<i>Single Bank Mowing/ Flailing in spring/summer</i>				
Whole bank cut - both sides	P	P	A	A
Whole bank cut - one side	P	A	A	A
Toe strip left - 0.25 m wide	A	A	A	A
Toe strip left - 0.25 - 1.0 m	A	A	A	G
Toe strip left - 1 m +	A	A	B	B
Top strip left - 0.25 m wide	P	P	A	A
Top strip left - 0.25 - 1.0 m	P	P	A	A
Top strip left - 1 m +	P	A	A	A
Selective cutting (< 20 %)	A	A	A	B
<i>Single annual Bank Mowing/ Flailing in autumn/ winter</i>				
Whole bank cut - both sides	P	A	A	A
Whole bank cut - one side	A	A	A	G
Toe strip left - 0.25 m wide	A	A	A	A
Toe strip left - 0.25 - 1.0 m	A	A	B	B
Toe strip left - 1 m +	A	B	B	B
Top strip left - 0.25 m wide	P	P	A	A
Top strip left - 0.25 - 1.0 m	P	P	A	A
Top strip left - 1 m +	P	A	A	A
Selective cutting (< 20 %)	A	A	A	B
<i>Mowing/ Flailing once every 3 -5 years to prevent scrubbing up</i>				
Whole bank cut - both sides	A	A	A	A
Whole bank cut - one side	A	A	G	G
Toe strip left - 0.25 m wide	A	A	G	G
Toe strip left - 0.25 - 1.0 m	A	A	G	G
Toe strip left - 1 m +	G	B	B	B
Top strip left - 0.25 m wide	A	A	A	G
Top strip left - 0.25 - 1.0 m	A	A	G	A
Top strip left - 1 m +	A	A	G	G
Selective cutting (< 20 %)	G	G	B	B
<i>Grazing</i>				
Light with topping in autumn	B	B	B	B
Light	B	B	B	B
Heavy	P	P	P	P

STAGE 5 ASSESS CHANNEL WILDLIFE QUALITY

This allows a rapid assessment of the wildlife quality of the river based on channel features. It takes no account of rare or protected species or sites that are designated for their wildlife value and it is expected that FER staff will have notified Flood Defence if these are present. If they are, then the quality of the watercourse is automatically High and FER staff should be consulted if anything other than Best, Good or Existing Practice is to be used.

Rivers with a high wildlife value usually have a range of different river features which typically depend on type and size of the watercourse and the management regime. The majority of rivers which are managed to control vegetation are less physically diverse than many unmanaged ones. Physical structure as well as the vegetation is a very important element in determining wildlife interest and many managed rivers have lost diversity of both. River channels of the best wildlife quality are likely to hold large amounts of all, or most, of the features listed below. Lower quality rivers will have fewer features present and/or smaller amounts of them. A river may be considered of high quality if it scores three or more high scores as described in the checklist below.

If the maintenance is to extend over a length of river more than 500m, divide it into reaches of no more than this length to make the assessment...

Checklist of channel features which indicate high quality

- *Variation in depth and velocity* (riffles, pools, rapids, runs/glides, slacks). Estimate the proportion of each in the reach being assessed for management. If no single flow type extends over more than half the reach or at least three flow types are present then score high.
- *Extensive beds or well-developed fringes* of dense submerged and/or emergent vegetation. Assess the extent of these on both sides of the channel within the assessment reach. If they are present in patches at least 5m long and 0.5m wide (or 10% of the channel width in channels <5m wide) for between a quarter and three quarters of the reach then score high.
- Well-developed *transitional zone* between river and edge of channel. Transitional zone features are sediment bars, mud exposures and shallow gradient banks including those containing reed. Where a well developed transitional zone with reed occurs this may also score highly under the preceding section. They must be damp at all times. If 25% of the reach has sediment exposed or transitional features present during low flows then score high.
- Many *minor habitat features* provide structural diversity to a channel. These include submerged tree roots, logs, small backwaters with accumulations of fallen leaves, large rocks, overhanging and trailing branches, marginal flood litter etc. If ten examples of these are present in a 500m length, or pro rata, but not less than two examples per 50m, then score high.

- *Aquatic plant forms.* Using the photographs on pages 19-21, identify how many forms occur in the assessment reach. If four or more forms of aquatic plant growth occur in a 500 m stretch then score high. For a shorter length then three or more forms should occur for it to score high.

The following photographs illustrate features in channels that make them of high wildlife quality. Use them together with the checklist of features most often associated with high wildlife quality to confirm the existing wildlife quality of your river. It should be noted that these photographs only illustrate features of high quality and do not provide a quality assessment for a reach.

Following the photographs of features are illustrations of the nine types of aquatic plants.



River Wey: This photograph illustrates variation in depth and flow. Additional points of note are earth cliffs, potentially valuable for kingfishers, and overhanging branches (also see Stage 6).



R. Great Ouse back channel: A range of plant forms including emergent beds, floating vegetation and a well developed transition zone between the land and water are important features. Overhanging trees and scrub provide shade and the unimproved adjacent land will increase the already high value.



Winterbourne: Variation in flow together with abundant fringes of marginal plants



R. Otter: Abundant instream vegetation coupled with clean well segregated sediments and marginal emergent vegetation make this a high quality river. Additional features include overhanging trees.



R. Piddle: The muddy edge and overhanging vegetation together with segregated substrates are good features. However, the channel is lacking in instream and submerged vegetation.



River Piddle: Extensive transitional zone with vegetated muddy margins,



River Swale: Examples of transitional and minor habitat features include shoals, back channel, exposed tree roots and overhanging trees. Additionally variation in flow is present.



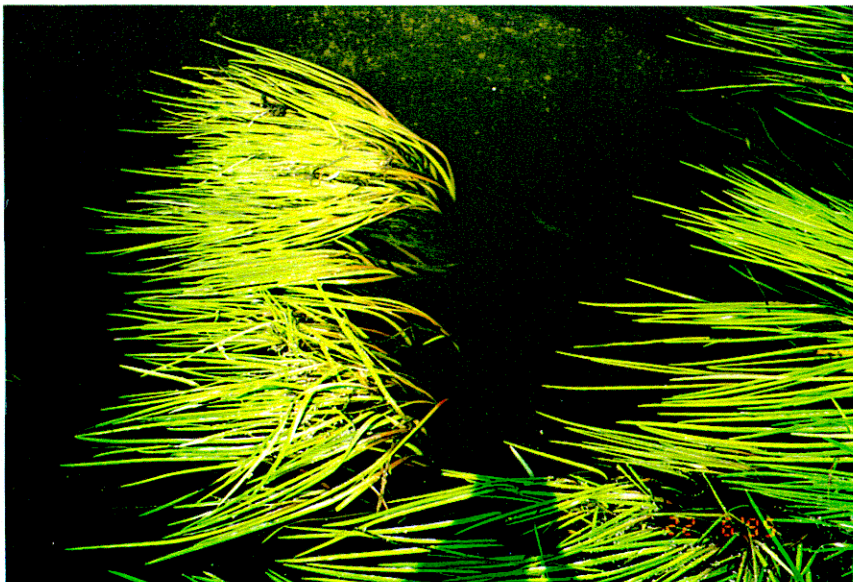
Warping Drain: Instream vegetation provides breeding sites for a range of birds, fish and invertebrates and the overhanging trees fronted with reed provide good transitional habitat.

Descriptions of the nine forms of aquatic vegetation

	Structure	Example
Form 1:	Broad-leaved submerged	Canadian Pondweed (<i>Elodea</i> spp.), Yellow Water lily (<i>Nuphar lutea</i>), Shining Pondweed (<i>Potamogeton lucens</i>)
Form 2:	Narrow linear/ ribbon -leaved submerged	Bulrush (<i>Schoenoplectus lacustris</i>), Arrowhead (<i>Sagittaria</i>), Unbranched Bur-reed (<i>Sparganium emersum</i>)
Form 3:	Finely dissected - leaved submerged	Milfoil (<i>Myriophyllum</i> spp.), Fennel Pondweed (<i>Potamogeton pectinatus</i>), Crowfoot (<i>Ranunculus</i> spp.)
Form 4:	Surface - floating	Broad-leaved Pondweed (<i>Potamogeton natans</i>), Yellow Water lily (<i>Nuphar lutea</i>), Duckweed (<i>Lemna minor</i>)
Form 5:	Submerged cushions	Bryophytes such as Willow moss (<i>Fontinalis</i> , <i>Rhynchostegium</i> , <i>Riccia</i>)
Form 6:	Narrow-leaved emergents	Branched Bur-reed (<i>Sparganium erectum</i>), Sharp Rush (<i>Eleocharis</i> spp.), Bulrush (<i>Schoenoplectus lacustris</i>)
Form 7:	Broad-leaved emergents	Great Water-dock (<i>Rumex</i>), Blue Water-speedwell (<i>Veronica anagallis-aquatica</i>), Fool's Water-cress (<i>Apium nodiflorum</i>)
Form 8	Amphibious/ marginal	Amphibious bistort (<i>Polygonum amphibium</i>), Reed sweet-grass (<i>Glyceria maxima</i>), Water Forget-me-not (<i>Myosotis scorpioides</i>)
Form 9:	Macro-algae	Blanket weed (<i>Cladophora</i>), Tubeweed (<i>Enteromorpha</i>), Netweed (<i>Hydrodictyon</i>)



Form 1: Broad-leaved submerged



Form 2: Narrow linear/ ribbon-leaved submerged.



Form 3: Finely dissected-leaved submerged.



Form 4: Surface-floating



Form 5: Submerged cushions



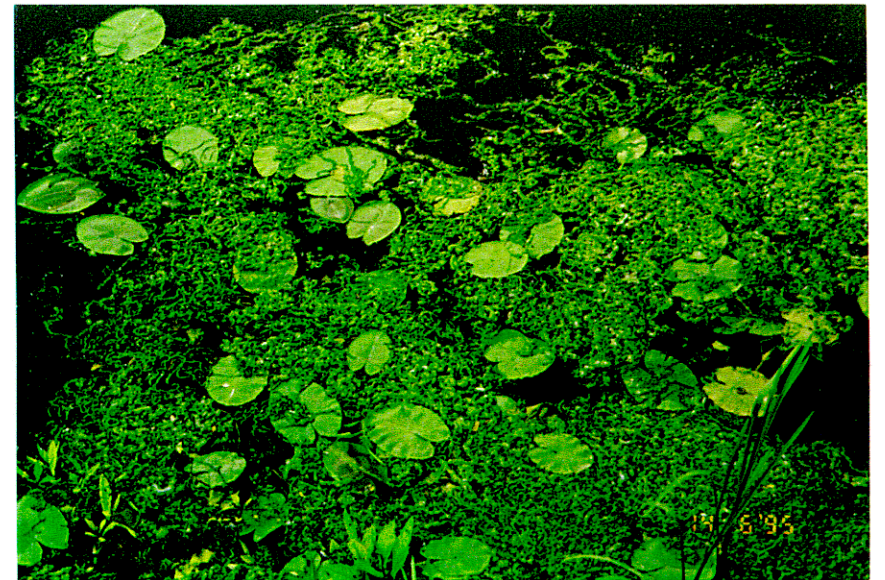
Form 6: Narrow-leaved emergents



Form 7: Broad-leaved emergents



Form 8: Amphibious/ marginal



Form 9: Macro-algae

STAGE 6 ASSESS BANK WILDLIFE QUALITY

This allows a rapid assessment of the wildlife quality of the river based on bank features. It takes no account of rare or protected species or sites that are designated for their wildlife value and it is expected that FER staff will have notified Flood Defence if these are present. If they are, then the quality of the watercourse is automatically High and Conservation staff should be consulted if anything other than Best, Good or Existing Practice is to be used.

Rivers with a high wildlife value usually have a range of different bank features which typically depend on type and size of the watercourse, vegetation structure and the management regime. The majority of rivers which are managed to control vegetation are less physically diverse than many unmanaged ones. Physical structure as well as the vegetation is a very important element in determining wildlife interest. Uniform banks are therefore not of high quality. Banks of high wildlife quality are likely to hold large amounts of all, or many, of the features listed below or show a wide variation in form. Those features that are asterisked below will not normally occur on managed banks. Accordingly banks subject to routine maintenance will not normally be considered as of High quality unless they hold all three of the non-asterisked features. However, if asterisked features are present, they may be included in the assessment and any three features scoring high will count.. Additionally, any bank should score High where if it has a continuous run of important transitional zone habitats (see channel wildlife quality) or natural tree cover.

If the maintenance is to extend over more than 500m of river, divide it into reaches of no more than this length to make the assessment.

Checklist of bank features which indicate high quality

* not normally present on managed banks

- Well-developed *transitional zone* between river and bank. Transitional zone features will include sediment bars, poached mud exposures, and shallow gradient banks including those containing reed. They must be damp at all times. If 25% of the reach has sediment exposed or transitional features present during low flows then score high.
- Many minor *habitat features* providing structural diversity. These include roots stabilising banks providing edge and underwater habitats, earth cliffs, boulders, soil slips, and cattle drinks. If ten examples are present in a 500m length or pro rata but not less than two examples per 50m then score high.
- *Herbage of varied heights* with a mix of tall stands and shorter areas. If grazed, then at low intensity with some areas short and others longer. If present over more than 25% of the length then score high.
- **Stands of bushes or scrub* (including bramble) with gaps or glades holding grass and herbs. If present over 50% score high.

- **Mixed structure of all vegetation types* which includes scrub, rank tall vegetation, short swards over more than half of the reach scores high.
- **Stands of trees* or well-spaced specimens. More than 20 individual specimens or 5 clumps score high.

The following photographs illustrate features on banks that make them of high wildlife quality. Use them together with the checklist of features most often associated with high wildlife quality to confirm the existing wildlife quality of your river. It should be noted that these photographs only illustrate features of high quality and do not provide a quality assessment for a reach.



River Great Ouse: Of note in this photograph is the transition on the left bank from the emergent vegetation via tall herbs to the wood behind. The opposite bank also contains tall herbage.



River Test: The variety of bank vegetation is of note as it provides considerable and varied cover with good continuity to the water's edge. The large overhanging tree is a good feature.



River Wiske: Earth cliffs and soil slips provide habitat diversity and banks also show a herbage of varied heights.



Torne Flood Banks: Variations in sward height improve the value of these floodbanks by providing cover for ground-nesting birds as well as feeding areas. Wetter patches in these areas are of note for dragonflies. The fringe of marginal vegetation provides some limited cover.



Winestead Drain: Patches of scrub, in this case bramble, are valuable for invertebrates and breeding birds as well as providing cover for otters.



River Swale: Mixed vegetation structure with trees and glades holding grass and herbs.



Meon Canal: Trees spaced along the river bank also showing a sward of varying height on the bank.

STAGE 7 ASSESSMENT OF ADJACENT LAND WILDLIFE QUALITY

As vegetation maintenance can potentially affect the water table in adjacent land it is essential to evaluate the wildlife value of adjacent land. It should be assumed to be of high wildlife quality if it contains *any* of the following features:-

- I. Woodland that includes permanent or seasonal open water.
- II. Woodland that is subject to regular flooding or has a high watertable (these typically contain alders and willows).
- III. Ponds or other open water bodies.
- IV. Swamp areas which are regularly flooded or have high watertables (these include tall-herb fens and fen meadows, true swamps, reedbeds, marshes etc).
- V. Grassland that is subject to regular flooding or has a high watertable from whatever source. This may include damp hay meadows, inundation grasslands or tussocky grassland which may be improved or unimproved.

The following photographs illustrate the features listed.

[Adjacent land that is of high wildlife value but is not dependent on water levels is not considered as High quality in the context of these Guidelines.]



I: Woodland with permanent open water



II: Wet woodland



III: Open Water



IV: Bulrush/rush swamp



IV: Reed/ milk parsley tall herb fen



V: Inundation Grassland



V: Flood meadow



V: Rush pasture

APPENDIX 1: EXAMPLES OF GOOD AND BAD WORKING PRACTICE IN CHANNELS

The following photographs illustrate good and bad working practice for wildlife. They may be compared with those illustrating features of wildlife quality to identify features that should be retained.

Top right: River Great Ouse

Bottom right: River Colne

Both are examples of good practice where the centre has been cleared to create a self cleansing channel and the fringes of emergent vegetation have been left. Compare this with the criteria for high wildlife quality.

Below: North Level Engine Drain (NLED)

The NLED has had a swathe cleared through the middle only, leaving the slow growing reed on the far margin untouched.





Top left: River Misbourne

Another example of good management. The Misbourne shows the results of narrow raking of the central half followed by recovery. The central channel is still open.

Bottom left: Drain at Hatfield Chase

Below: Owsten Ferry

Both are examples of bad management leaving no instream habitat and also taking the bottom of the bank to remove the transition between the bank and water. The vegetation in the water has been cut. Also see River Lambwath (Appendix 2)



APPENDIX 2: EXAMPLES OF GOOD AND BAD WORKING PRACTICE ON BANKS

The following photographs illustrate good and bad working practice for wildlife. They may be compared with those illustrating the banks of different wildlife quality to identify the features that should be retained.

Above right: Warping Drain

This shows good practice with the effects of grazing leading to a mosaic of vegetation structure. The important fringes providing continuity between the water and land are maintained under such a regime.

Bottom right: Torne system

This picture shows good management on the left bank where a narrow fringe of reed has been left and poor practice on the right bank which has been uniformly managed. If conveyance is critical, then variation through a more relaxed mowing regime could have been introduced at the top of the right bank which is higher than the left.

Below: Torne system

This shows good management in leaving the base of the bank and a substantial emergent fringe untouched. This provides the interface between water and land needed by many invertebrates.





Top left: River Lambourne

The two banks show different characteristics following different treatment. The left shows regular mowing leaving a marginal fringe while the right is not managed so regularly and has a greater extent of tall vegetation.

Bottom left: Ferring Rife

This is acceptable practice. A small toe has been left on one bank with the other bank left unmown. The problem of leaving long cut vegetation can clearly be seen. Dying and rotting herbage tends to suppress other plants and reduce the variety of the vegetation. Grasses and invasive plants such as creeping thistle may be fostered.

Below: Lambwath

This is generally unacceptable practice. Managed by Bradshaw bucket, the channel has been completely cleared but the far bank has also had the interface with the water stripped of its vegetation. On the near bank the berm has had its vegetation removed but the cross-section diversity has been maintained.

