

## Biophysical Interactions

# “Checking the Pulse of the Hawkesbury River”



Name \_\_\_\_\_



ACKNOWLEDGED BY



## PRELIMINARY COURSE OUTCOMES

### Senior Geography Outcomes

- P2** describes the interactions between the four components which define the biophysical environment
- P3** explains how a specific environment functions in terms of biophysical factors
- P6** identifies the vocational relevance of geographical perspective
- P8** selects, organises and analyses relevant geographical information from a variety of sources
- P9** uses maps, graphs and statistics, photographs and fieldwork to conduct geographical inquiries
- P10** applies mathematical ideas and techniques to analyse geographical data

## HEALTH & SAFETY ISSUES

As you are working out in the field you need to be aware that;

- Ground materials can be slippery
- Edges of the river can be quite deep and muddy
- Some animals can deliver painful or venomous bites

# INVESTIGATION TASK

Ulinbawn Ski Park at Sackville North has requested a detailed assessment and report on the current ecological status of the river and adjacent land. This report will inform all future decision making and provide a basis from which ecosystem rehabilitation can begin. The report will require a detailed assessment of the following areas:

- Water quality (hydrological and physio-chemical)
- Riverbank and riparian zone health (erosion, run-off and biodiversity)
- Biological characteristics via algal surveys

## Pre Visit Tasks

Watch the pre visit video and read the ‘Natural Resource Management Issues’ PDF file to answer the following questions.

1. What is a catchment?

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2. Identify and describe the location and nature of the Hawkesbury Nepean Catchment.

Location: \_\_\_\_\_

Size: \_\_\_\_\_

Natural habitats: \_\_\_\_\_

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3. List 4 ‘ecosystem services’ that the river provides:

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4. Choose 1 Natural Resource Management Issue (eg “Issues affecting Land and Soil”) and explain the issues below.

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5. Explain why river nutrient loads are decreasing.

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6. List some of the physical, chemical and biological parameters you will be measuring.

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## Water Quality Assessment Field Data Collection Sheet

Sample Site Location:	<b>Hawkesbury River at Ulinbawn Ski Park Sackville North</b>	GPS Easting	
		GPS Northing	
Sample Collection Time:		Sample Collection Date:	
Weather Conditions:	previous 24hrs;	previous 48 - 120hrs;	
Tide: ebb tide [running out to low] / flood tide [running in to high]			

### Hydrological Parameters

Parameter	Units of measurment	Site number	Site Description Hawkesbury River at Ulinbawn Ski Park Sackville North
Width of the River	metres	all	how wide is the river?
Depth at Sample Site	metres	1	Depth near the Cliffs
	metres	2	Depth in the Middle
	metres	3	Depth at Caravan Beach

### Biological Parameters

Parameter	Species Diversity	Species ID	Taste and Odour imparting	Filter Clogging Organisms	Polluted Water Species	Other surface water phytoplankton
Phytoplankton identification	1					
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					
Vertbrate ID	1		4			
	2		5			
	3		6			

Physio-chemical Water Quality Parameters						
Parameter & Units of Measurement	ANZECC Trigger Values for Ecosystem Protection	Site Description	Sample Depth			What is the mean / average level
			1.0m			
Temperature (Temp) °C	N/A	Near the Cliffs (west)				
		Middle of the River				
		Closest to the Caravans (east)				
pH	6.5 - 7.5	Near the Cliffs (west)				
		Middle of the River				
		Closest to the Caravans (east)				
Dissolved Oxygen (DO) % saturation	85 - 110	Near the Cliffs (west)				
		Middle of the River				
		Closest to the Caravans (east)				
Dissolved Oxygen (DO) mg/L	>5	Near the Cliffs (west)				
		Middle of the River				
		Closest to the Caravans (east)				
Electrical Conductivity (EC) uS/cm	200 - 300	Near the Cliffs (west)				
		Middle of the River				
		Closest to the Caravans (east)				
Turbidity ntu	<50	Near the Cliffs (west)				
		Middle of the River				
		Closest to the Caravans (east)				
PO <sub>4</sub> mg/L	0.02	Near the Cliffs (west)				
		Middle of the River				
		Closest to the Caravans (east)				
NO <sub>x</sub> mg/L	0.04	Near the Cliffs (west)				
		Middle of the River				
		Closest to the Caravans (east)				

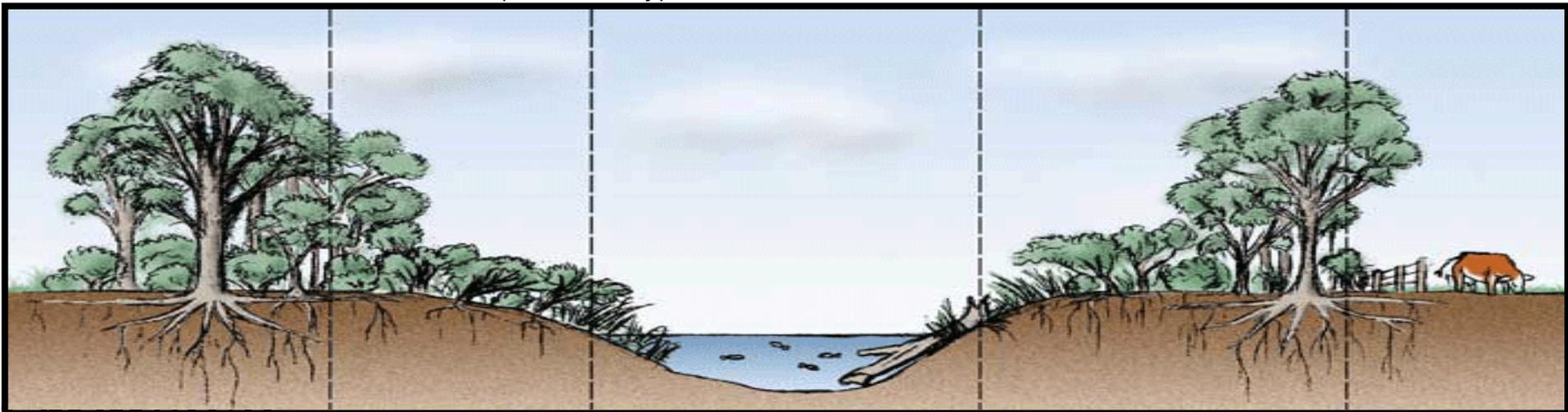
# Riverbanks and Riparian Zones

Riverbanks and riparian zones link terrestrial and aquatic habitats and play a key role in determining the health of the waterway.

The three major roles are;

- Filtering sediment and nutrients entering the waterway
- Stabilising the soil and reducing erosion
- Creating a diverse array of plant and animal habitats

(biodiversity)

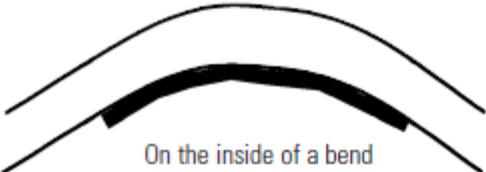
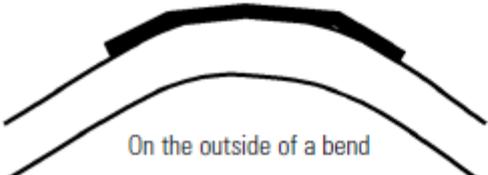


## Erosion Assessment

Use the following checklist to assess the **erosion risk** for the site. The site boundaries will be from one end of the beach to the other. This checklist is taken from “Guidelines for monitoring riverbank health in the Hawkesbury Nepean” (2002) NSW Department of Land and Water.

### Checklist 6: Riverbank Erosion Risk

#### Q1. Riverbank site location

Is your riverbank site located mainly:	Score	Your Score
 <p>On the inside of a bend</p>	0	
 <p>On a straight reach of the river</p>	1	
 <p>On the outside of a bend</p>	3	
SCORE	(0-3)	

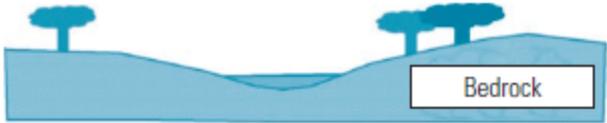
#### Q2. Location on an outside bend

Complete this question only if you are located on the outside of a bend.

Note: Arrows in stream show **direction** of downstream flow from headwaters.

Your site	Score	Your Score
 <p>On the UPSTREAM part of bend</p>	0	
 <p>On the DOWNSTREAM part of a bend</p>	1	
SCORE	(0-1)	

### Q3. River landform description

Is the river or stream at your site best described as:	Score	Your Score
 <p data-bbox="772 416 948 450">Bedrock</p> <p data-bbox="475 483 804 517">Fully/mostly confined by bedrock</p>	-2	
 <p data-bbox="772 640 948 674">Unconsolidated</p> <p data-bbox="475 707 740 741">Partly confined by bedrock</p>	-1	
 <p data-bbox="475 931 836 987">Unconfined (floodplain present) with no obvious levee banks</p>	2	
 <p data-bbox="475 1155 836 1211">Unconfined (floodplain present) with obvious raised levee banks</p>	3	
SCORE (-2 to 3)		

### Q4. Bank shape

Which of the following best describes the overall shape of your riverbank at the site? (choose only one).		
 <p data-bbox="363 1570 539 1603">Gently sloping = 0</p>	 <p data-bbox="804 1570 916 1603">Convex = 1</p>	
 <p data-bbox="363 1749 485 1783">Concave = 2</p>	 <p data-bbox="804 1749 932 1783">Stepped = 2</p>	
 <p data-bbox="363 1917 533 1951">Near vertical = 3</p>	 <p data-bbox="804 1917 932 1951">Undercut = 3</p>	
SCORE (0 to 3)		

**Q5. Bank sediment types**

How would you describe the general nature of your riverbank material at the site?	Score	Your Score
<ul style="list-style-type: none"> <li>• Bedrock (the sides of the river or stream channel are lined with solid bedrock)</li> <li>• Boulders or cobbles (rock material greater than 60mm in diameter)</li> <li>• Bedrock at the base (toe) of the bank but other material above</li> <li>• Gravelly (bank material diameter between 2 - 60mm)</li> <li>• Clayey</li> <li>• Sandy</li> </ul>	<p>-3</p> <p>-1</p> <p>0</p> <p>1</p> <p>2</p> <p>4</p>	
YOUR SCORE (-2 to 3)		

**Q6. Bank geometry**

<p>Dimension details (metres)</p> <p>Estimated average height of riverbank (vertical height from low water mark to top of bank) = ____</p> <p>Estimated average width of riverbank (horizontal distance from low water mark to the top of the bank) = ____</p> <p>Ratio bank height/width = ____</p>	<p>Draw a typical bank profile for your riverbank site</p>	
	RATIO and SCORE	YOUR SCORE
Is your height to width ratio:	<p>1:2 or &gt; 1;2 =0</p> <p>&lt;1:2 = 2</p>	

**Q7. Riverbank vegetation – erosion protection**

Amount of riverbank vegetation and score		Your Score
How much of your riverbank site is covered with vegetation?	<p>Reeds, sedges and rushes present along more than half of the length of the riverbank at the site in and/ or just above the water shallows: YES = -1 NO = 1</p> <p>More than half of the base (toe) of the riverbank contains trees and/or shrubs, ferns and grasses: YES = -2 NO = 1</p> <p>More than half of the slope of the riverbank is covered with trees and/or shrubs ferns and grasses: YES = -1 NO = 1</p> <p>More than half of the top of the bank is covered with trees and/or shrubs: YES = -1 NO = 1</p>	
SCORE (-5 to 4)		

### Generating your Final Erosion Risk Score

Question number	Possible scores	Your score
Q1 Location	0 to 3	
Q2 Outside Bend	0 to 1	
Q3 Landform	-2 to 3	
Q4 Bank Shape	0 to 3	
Q5 Sediment Type	-3 to 4	
Q6 Geometry	0 to 2	
Q7 Vegetation	-5 to 4	
Possible Final range of scores	-10 to 20	Your Total score =

### Assigning an Erosion Risk Class

<b>TOTAL SCORE</b> (sum of scores from Q1-7 above) =	
<b>Erosion Risk Class assigned from Total Score</b>	
<input type="checkbox"/> Erosion Risk Class 1 = Total score -10 to +1	<b>Low erosion risk</b> – bank naturally not prone to serious erosion
<input type="checkbox"/> Erosion Risk Class 2 = Total score +2 to +7	<b>Medium erosion risk</b> – bank has the capacity for serious erosion unless managed.
<input type="checkbox"/> Erosion Risk Class 3 = Total score + 8 to 20	<b>High erosion risk</b> – bank is highly susceptible to erosion even under natural conditions. It requires careful management to help reduce erosion.

What measures would you recommend be undertaken to reduce the erosion risk of this site?

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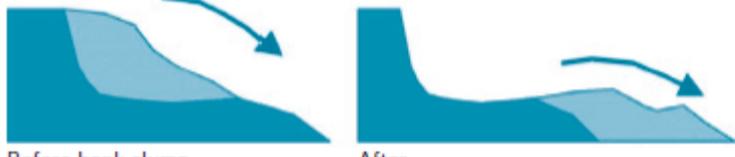


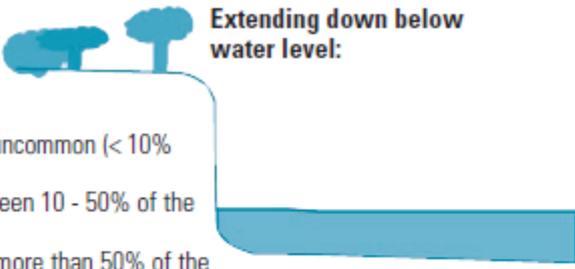
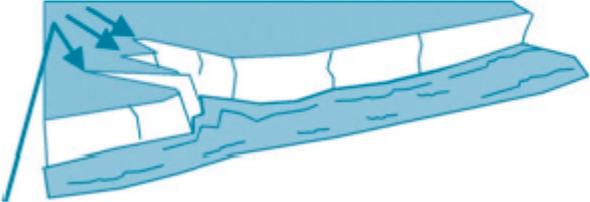
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# Current Erosion Condition Assessment

## Checklist 7: Riverbank Erosion Condition

Types of Erosion – does your site show any of these features?

<p><b>SLUMPING</b></p>  <p>Before bank slump      After</p> <p><b>Big slumps high up on the bank, or extending further back</b></p> <ul style="list-style-type: none"> <li>• Not present = 0</li> <li>• Present but uncommon (&lt; 10% of bank) = 1</li> <li>• Occupy between 10 and 50% of the bank length = 3</li> <li>• Occupy more than 50% of the banks length = 5</li> </ul> <p>Potential cause is flood damage. Manage by revegetating with deep rooted native trees.</p>	<p><b>Score</b></p>
 <p>Before bank slump      After</p> <p><b>Localised smaller slumps either on the base, slope or top of the bank</b></p> <ul style="list-style-type: none"> <li>• Not present = 0</li> <li>• Present but uncommon (&lt; 10% of bank) = 1</li> <li>• Occupy between 10 - 50% of the bank length = 3</li> <li>• Occupy more than 50% of the banks length = 5</li> </ul> <p>Potential causes are lack of vegetation, flood damage, stock or human access on sandy banks. Manage by planting deep-rooted natives and controlling access.</p>	<p><b>Score</b></p>
 <p>Before      After</p> <p><b>Undercutting of bank base and toppling</b></p> <ul style="list-style-type: none"> <li>• Not present = 0</li> <li>• Present but uncommon (&lt; 10% of bank) = 1</li> <li>• Between 10 - 50% of the bank length = 3</li> <li>• Common on more than 50% of the banks length = 5</li> </ul> <p>Potential causes are lack of deep rooted native vegetation, wind or wave action in larger rivers or speed of stream flow in smaller streams. Manage by paying special attention to protecting the toe of the bank. Plant native vegetation which does not mind wet feet. Encourage in-stream vegetation and retain snags against the bank if they are not causing erosion.</p>	<p><b>Score</b></p>

<p><b>VERTICAL BANK SECTIONS</b></p>  <p><b>Extending down below water level:</b></p> <ul style="list-style-type: none"> <li>• Not present = 0</li> <li>• Present but uncommon (&lt; 10% of bank) = 0</li> <li>• Occupy between 10 - 50% of the bank length = 1</li> <li>• Common on more than 50% of the banks length = 3</li> </ul> <p>Potential causes of channel widening are speed and volume of water flow. Manage by revegetating with native plants from the top of the bank.</p>	<p><b>Score</b></p>
<p><b>GULLY EROSION</b></p>  <p><b>Running perpendicular to the river down the face of the bank:</b></p> <ul style="list-style-type: none"> <li>• Not present = 0</li> <li>• Present but uncommon (&lt; 10% of bank) = 0</li> <li>• Impacts between 10 - 50% of the bank length = 1</li> <li>• Common on more than 50% of the bank length = 2</li> </ul> <p>Potential causes are runoff from adjacent land, poor drainage, lack of vegetation in appropriate areas and stormwater. Manage by addressing drainage issues. Plant water soaking native shrubs and trees at heads of gullies.</p>	<p><b>Score</b></p>
<p><b>TOTAL SCORE (SUM OF SCORES) =</b></p>	

**Assigning an Erosion Risk Class**

<p>TOTAL SCORE (SUM OF SCORES ABOVE) =</p>			
<p>Current Erosion Condition Class assigned from above Total Score</p>	<p><input type="checkbox"/> Erosion Condition Class 1 Total score 0-4</p> <p>Bank generally in good condition with little or no erosion.</p>	<p><input type="checkbox"/> Erosion Condition Class 2 Total score 5-8</p> <p>Bank in a fair condition with erosion becoming a significant problem</p>	<p><input type="checkbox"/> Erosion Condition Class 3 Total score 9 to 21</p> <p>Bank appears to be significantly degraded with most of the bank suffering some form of erosion</p>

## Conclusions and Recommendations

1. List any physio-chemical water quality data results that were outside ANZECC trigger values:

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2. Explain why you think these results fell outside the 'normal' range set by ANZECC

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3. Describe some management actions that you would recommend be undertaken to improve water quality outcomes in the Hawkesbury River. (eg. how can our community continue to reduce nutrient loads in the river).

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4. How many different Algal species did you identify? What does this indicate about river health?

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5. What did your 'erosion risk' and 'current erosion condition' assessment indicate about the site?

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6. What management actions would you recommend that the ski park implements to reduce erosion risk and improve the current condition?

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7. Discuss how reducing erosion will improve water quality in the Hawkesbury River.

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