Peel-Harvey design report.

Team: Class: Date:

Your team's record of the design challenge. Page 1 is the brief and your criteria, pages 2 and 3 the science your design needs, page 4 your designs and tests, and page 5 your design report.

SCREEN 1 The brief

It is 1989. The Western Australian Government wants a plan to fix the Peel-Harvey Estuary at Mandurah, where green weed has spread since the 1960s and toxic Nodularia blooms have covered the Harvey Estuary in many summers since 1978. Your team's plan has 25 years to work, from 1990 to 2014, and a budget of 10 points.

DEFINE Our criteria

CRITERION	HOW IT IS TESTED	OUR RANKING	MET BY OUR BEST RUN?
No toxic Nodularia blooms in the basins	No blooms in the last 10 years of the run	☐ Must ☐ Should ☐ Nice to have	
Less weed on the shores	Macroalgae averages under 5,000 tonnes over the last 10 years	☐ Must ☐ Should ☐ Nice to have	
Seagrass coming back	Seagrass is over 5,000 tonnes at the end of the run	☐ Must ☐ Should ☐ Nice to have	
Fewer fish kills in the rivers	Fewer than 3 years with a fish kill in the last 10 years	☐ Must ☐ Should ☐ Nice to have	
Crabs and fish to catch	The crab index is 60 or more at the end of the run	☐ Must ☐ Should ☐ Nice to have	
An affordable plan	The plan costs no more than 10 points	Constraint	

Our own criterion, and how we would measure it

Why does a design team agree on its criteria before it starts designing?

SCREEN 3

Energy: the food web

Draw an arrow from each food to what eats it, or to what it becomes. The arrow points the way the energy goes.

Top of the web

Tailor

People

Eat those animals

Hardyheads

Blue swimmer crab

Yellowfin whiting

Eat producers or detritus

Zooplankton

Shellfish

Worms

Sea mullet

Producers, and detritus

Phytoplankton

Seagrass

Green weed

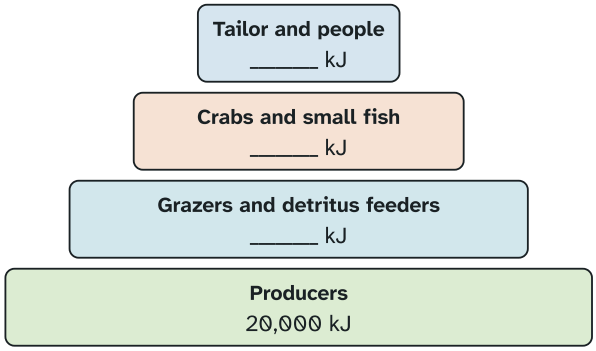
Detritus

The Sun

Sunlight

Fill in the energy that reaches each level if 10% passes from one level to the next.

Why does so little energy reach the top?

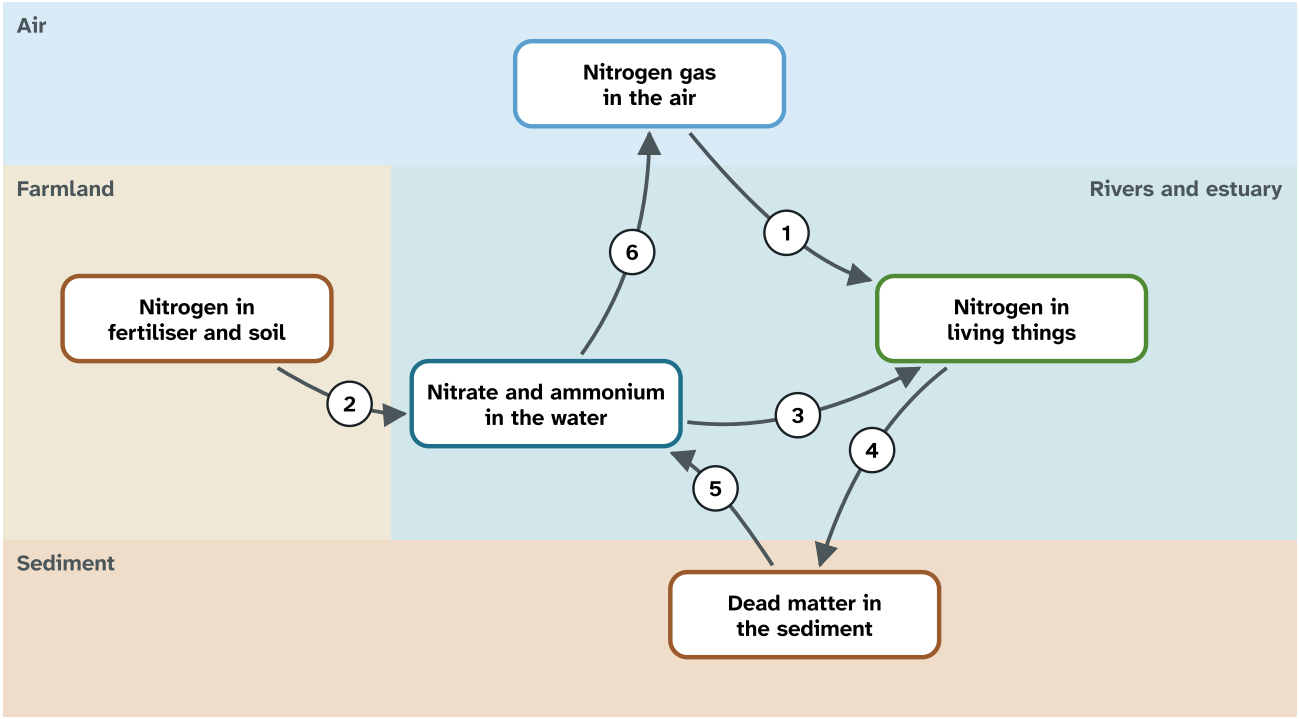


Take out the seagrass. Which animals lose food, and what does a food web not show about seagrass?

How is the way energy moves through the estuary different from the way nitrogen moves?

SCREEN 4 Matter: the nitrogen cycle

Name the six processes that move nitrogen between the stores, and the spheres each one links.



NO.	PROCESS	FROM WHICH SPHERE TO WHICH
1		
2		
3		
4		
5		
6		

Which process lets Nodularia grow when there is little nitrate or ammonium in the water, and why does that make cutting phosphorus so important?

SCREEN 4 Phosphorus

Which land use sends the most phosphorus to the estuary, and why do the sandy soils of the coastal plain lose so much of it?

SCREEN 7 Our design

Our first plan, and why we chose each part

Our prediction: which criteria will the plan meet, which might it miss, and why?

SCREEN 8 Test and redesign

Record each run in the simulator on screen 8.

RUN	WHAT WAS IN THE PLAN	COST	WEATHER PATTERN	CRITERIA MET	WHAT WE CHANGED NEXT, AND WHY
1					
2					
3					
4					
5					
6					

Our best plan, and what we changed to get there

SCREEN 10

Our design report

1. The problem. What went wrong in the Peel-Harvey, and which criteria did your team rank highest?

2. The science. How do energy and matter, including nitrogen and phosphorus, flow through the living and non-living parts of the estuary? Use the food web and the nutrient model.

3. Our design. What was in your plan, why did you choose each part, and what did it cost?

4. Testing. How did your plan do against the criteria and with different weather, and what did you change between runs?

5. Comparison. How does your plan compare with the 1989 plan, and with what happened after the channel opened?

6. Next steps. What would your team change, and what more would you want to find out?