

Stage 5 Geography
 Environmental Change and Management – Full Day

Student Name: _____

Case Study: Penrith Lakes

Task 1 *Sequent occupance (land use history) of the Penrith Lakes Area. Environmental change.*

Match the time periods below with the land uses for the Penrith Lakes Area. The first one is done for you.

Time periods : 2000	1880's	1789	Pre-human occupation	2015
1790's	For 6,000+ years	1960's	1980's to today	

A. The floodplain area of Penrith Lakes was mainly untouched Tall Open Forest.

Pre-human occupation

B. Aboriginal people (Darug tribe) used the land as a food source (hunting and gathering).

C. Captain Tench 'discovered' the Nepean River.

D. First occupation of land by European farmers. They create a food bowl for Sydney.

E. Sand and gravel extraction begins at Birds Eye Corner (on river beds).

F. Extraction of sand and gravel starts at Penrith Lakes site (on the floodplain).

G. The Olympic rowing event was held at Penrith Lakes.

H. Sand and gravel quarrying ends.

I. Rehabilitation of the Penrith Lakes Area into a 'water and park playground'.

This diagram refers to Station 4 (page 4) - Management Practices



Key question : What are the consequences of the change in the environment at PL?

(This is assessed by first-hand investigations of water quality and animal populations at a lake site)

Terms explored:

- **Phosphate levels** (nutrients/plant food) - High phosphate levels can lead to overgrowth of plants, decreased oxygen levels and increased algal blooms.
- **Turbidity** (water clarity) - High turbidity ('muddy' water) increases water temperature and reduces sunlight penetration, which reduces the ability of submerged plants to grow and produce oxygen.
- **pH** - the waters acidity or alkalinity level. Small changes in pH can endanger many types of plants and animals.
- **Conductivity** - level of total dissolved solids in the water (mainly salt). High salt levels make conditions uncomfortable for freshwater animals and plants. It can also have an impact on pH levels. E.g. higher TDS reading, the higher pH number.
- **Temperature - High/low water temperatures** mean more stress on organisms, lowering their resistance to pollutants and diseases.

Station 1 - Water Testing

Water Test	Instrument	Water Test	Instrument
Phosphate	Test tablet kit (ppm)	pH	Universal indicator paper (a number)
Turbidity	Turbidity Tube (ntu)	Conductivity	Total Dissolved Solids Scan (ppm)
Temperature	Thermometer (°C)	Appearance	Observation (use your eyes)

Final Detention Basin/Rowing Lake - use your results to circle a point score							
Phosphate (nutrients): _____ ppm				pH: _____			
0 - 1 ppm	>1 - 2 ppm	>2 - 3 ppm	>3 - 4 ppm	6.5 - 8.5	8.6 - 9.0	6.0 - 6.4	<6 or >9.0
8	6	2	0	8	6	4	0
Turbidity (clarity): _____ ntu				Conductivity (salts): _____ ppm			
<10 ntu	10 - 20 ntu	20 - 50 ntu	>50 ntu	<250 ppm	251-650 ppm	651-1000 ppm	>1000 ppm
8	4	2	0	8	6	4	0
Temperature: _____ °C				Appearance			
Summer	20 - 30 °C	Summer	>30 °C	Clear	Cloudy/some colour	Muddy/murky	Oily/scummy and/or smelly
Autumn/ Spring	15 - 25 °C	Autumn/ Spring	<15 or >25 °C	8	6	2	0
Winter	10 - 20 °C	Winter	>20 °C				
8		4		Overall Score Final Detention Basin: _____			

Overall Rating	Excellent	Very Good	Good	Fair	Poor	Very Poor
Final Detention Basin	42+	37 - 41	32 - 36	25 - 31	20 - 24	<20

Station 2 - Invertebrate survey (using a dip net)

Terms explored:

- **Aquatic invertebrates** (no backbone) - are small animals, such as insects, snails, crustaceans and worms that live in water.
- **Aquatic birds** - bird species which occupy water environments for most of their lifetime.
- **Bioindicators - invertebrate communities** are often used as indicators of aquatic ecosystem health because many species are sensitive to pollution and sudden changes in their environment. Community characteristics—such as abundance, richness, diversity, evenness, and community composition—can be monitored to determine whether the community is changing over time due to human-caused impacts.
 - **aquatic birds** can be reliable indicators of nutrient status, fish stocks or the abundance of aquatic plants.

Note: Invertebrate survey results will be discussed in the wrap up after lunch

Invertebrate Name	S.R.	Invertebrate Name	S.R.	Invertebrate Name	S.R.
1. Backswimmer		7. Mayfly Nymph		13. Water Spider	
2. Caddisfly Larvae		8. Pond Snail		14. Water Treader	
3. Damselfly Nymph		9. Water Beetle		15. Worm	
4. Dragonfly Nymph		10. Water Boatman		16. Mosquito Fish (vertebrate)	
5. Freshwater Shrimp		11. Water Mite		OTHER:	
6. Giant Water Bug		12. Water Scorpion		Note: S.R.= Sensitivity Rating	

Invertebrate Results (Circle the appropriate number and rating)					
Total Species Found	0-2 poor	3-4 fair	5-6 good	7-8 very good	9+ Excellent
Total invertebrate Population	0-10 poor	11-20 fair	21-30 good	31-40 very good	40+ Excellent

Station 3 - Bird survey (your observation)

During your time at the lake, identify aquatic birds. Circle the bird name below, if it was identified.

Coot (white beak)	Black Duck	Black Cormorant	Egret	Grebe
Heron	Moorhen (red beak)	Pied Cormorant	Pelican	Stilt
Swamphen	Wood Duck	Other _____	Other _____	

Aquatic Birds Results (Circle the appropriate number and rating)					
Total Species Identified	0-1 poor	2-3 fair	4-5 good	5-6 very good	7+ Excellent

Key question : How can changes to the environment at Penrith Lakes be managed?

(This is observed by a water management walk)

Station 4 - Management Practices (water management walk)

Terms explored:

- **Sustainable** - able to be maintained for the use of future generations.
- **Rehabilitation** - bringing back to a positive condition. (also- the act of restoring something to its original state)
- **Detention Basin** - lakes designed to stop or hold back water so be can be managed. The water is on 'detention'.

Introduction - Water Management Practices

Before reaching the Final _____ Basin (1) {refers to (1) in the picture on page 1} , stormwater has been treated at a number of sites and slowed down by the _____ of ponds. Within the Final Detention Basin there are some further water management practices in place to ensure the stormwater is clean enough for recreational use. For sustainable recreational water a well balanced native _____ needs to be in place.

Water Management Practices

- Word List:**
- | | | | | | |
|---------|-----------|------------|----------|-----------|----------------|
| sluice | chain | harvesting | air pump | detention | stratification |
| bass | nutrients | turbidity | boom | carp | blue-green |
| perched | wetlands | submerged | screen | ecosystem | spraying |

	Problem	Effects on water quality	Management
A	High nutrient run off	Encourages _____ algal blooms.	(2) _____ wetlands (use up nutrients) (3) Floating Treatment _____ .
B	Excessive sediment from land clearing and non sealed areas	Causes turbid (brown) water which raises water temperature and lower O2 by blocking sunlight.	(4) A silt _____ (filters sediment). (2) _____ wetlands (slows inflow). (1) Detention basin system and (8) sluice gate.
C	_____ (high water surface temperatures and low bottom temperatures)	Stratified water (low O2 at bottom level) releases _____ from "floor" sediment. Warm top layer encourages algal blooms.	(5) An _____ and hoses create currents to mix water. (6) Remote temperature sensor (yellow floating buoy with solar panels) triggers the air pump.
D	Petrochemicals (e.g. oil) and litter	Harmful impacts on ecosystem life. Blocks sunlight (low O2).	(7) A trash _____ holds back oil and litter.
E	Polluted storm water/ storm events	First flush run-off brings pollutants. Large flows can exceed basin capacity.	(8) _____ gate can be closed for pollutants or opened when water quality is good or during flooding/storms.
F	European _____ (introduced fauna)	High _____ - carp stir up sediments and rip out water plants which leads to lower oxygen and higher nutrients.	Electro-fishing (in the past). (9) Stocking the lakes with _____ . They eat young carp. (biological control)
G	Hydrilla	Hydrilla canopies, lowering oxygen by blocking sunlight. Chokes out _____ plants.	(10) Weed _____ . (11) Selective _____ . (12) Covering with mats.