

News Report, 24 Jan 2016:

Bradenton Herald (Florida, USA)

“Are we in for a repeat of last year’s red tide?”

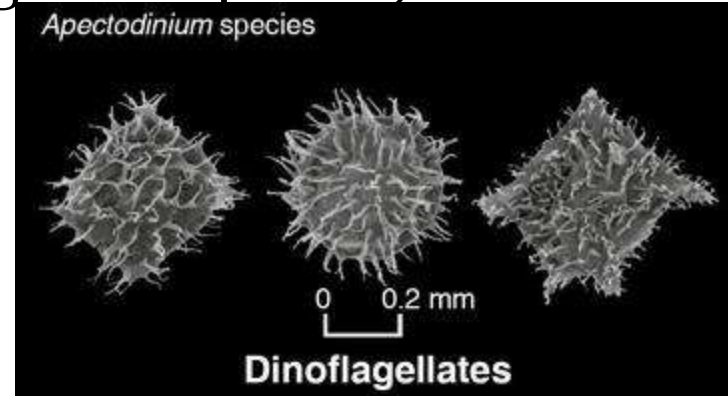
What is going on?

**Red tide** = algal bloom  
(dinoflagellate species)

Excess nutrients → phytoplankton  
population explosion →...

Plankton release toxins → kill fish and  
accumulate in shellfish →...

Can poison humans



# Water Pollution: Solutions and Management



ESS 2017

## Learning Objectives

Able to describe the process of eutrophication

Able to describe the impacts of eutrophication using graphs

Able to evaluate actions for managing eutrophication

## So... What is eutrophication?

Excess nutrients (e.g. N, P and K) in water

leading to excess growth of phytoplankton and aquatic plants

leading to...

# Eutrophication Process

Write the steps below in the **correct order** to show the process of eutrophication.  
Label these from **1, 2,...**

- > algae die and are decomposed by bacteria
- > decomposition of algae increases biological oxygen demand
- > nutrients promote plant growth, especially algae
- > nutrients remain in lake in organic matter or in sediment
- > excess nutrients e.g. N, P and K, enter waterways
- > algal bloom occurs
- > fish, macroinvertebrates and other aquatic life forms die
- > there is a drop in oxygen levels

**Why is this a “vicious cycle”?**

# Impacts of Eutrophication

Oxygen-deficient water (hypoxic) →

Death of aerobic organisms e.g. fish, invertebrates, amphibians →

Increased turbidity of water →

Death of higher-trophic-level plants e.g. reeds, waterlilies →

Loss of biodiversity and reduced food webs →

Reduced system resilience (ability to recover) →

Possible change in equilibrium and/or new system (less complex/poorer)

# Impacts of Eutrophication

On the set of axes  
With a key (colours) draw  
curves to show changes  
in:

Nutrients

Algae

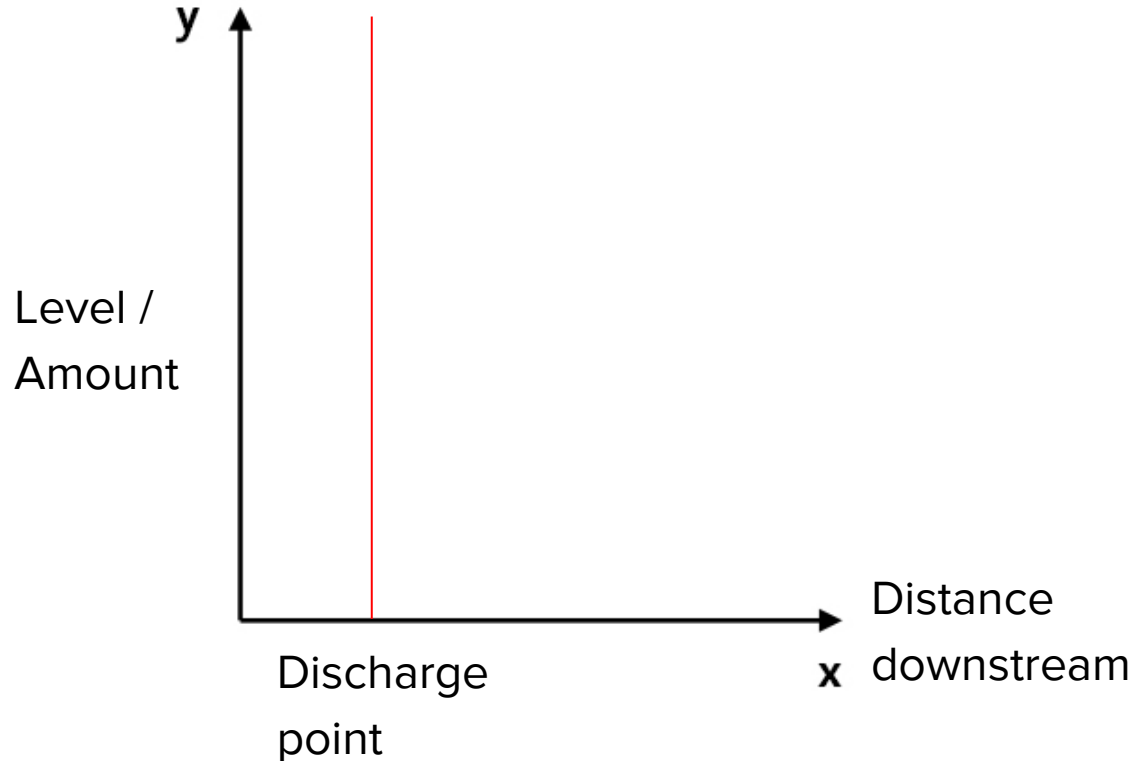
Detritus

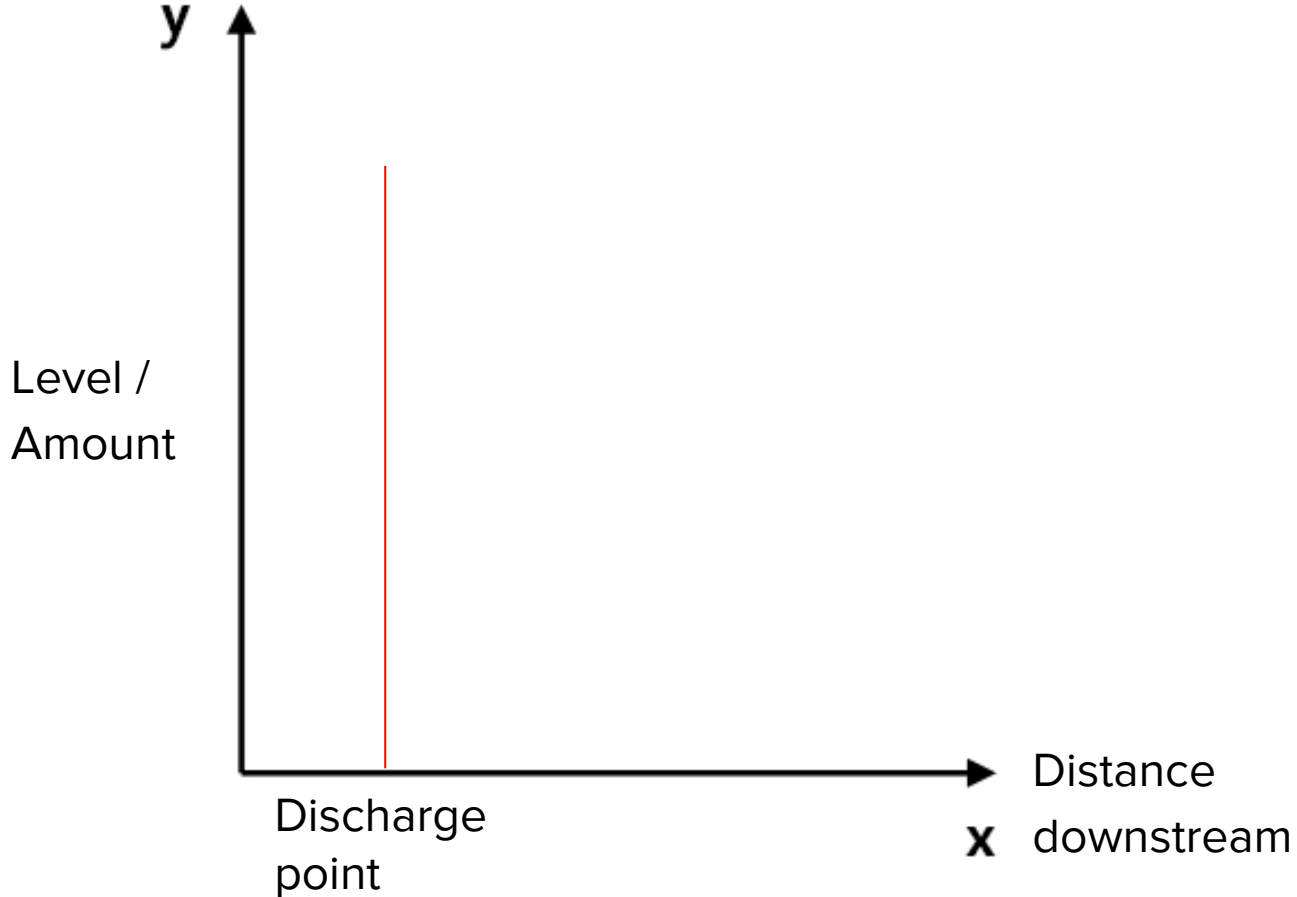
Bacteria

BOD

Oxygen level



Biodiversity







# Pollution Management Model

Process of pollution	Level of pollution management
<p>HUMAN ACTIVITY PRODUCING POLLUTANT</p> 	<p><b>Altering human activity</b></p> <p>The most fundamental level of pollution management is to change the human activity that leads to the production of the pollutant in the first place, by promoting alternative technologies, lifestyles and values through:</p> <ul style="list-style-type: none"><li>• campaigns</li><li>• education</li><li>• community groups</li><li>• governmental legislation</li><li>• economic incentives/disincentives.</li></ul>
<p>RELEASE OF POLLUTANT INTO ENVIRONMENT</p> 	<p><b>Controlling release of pollutant</b></p> <p>Where the activity/production is not completely stopped, strategies can be applied at the level of regulating or preventing the release of pollutants by:</p> <ul style="list-style-type: none"><li>• legislating and regulating standards of emission</li><li>• developing/applying technologies for extracting pollutant from emissions.</li></ul>
<p>IMPACT OF POLLUTANT ON ECOSYSTEMS</p>	<p><b>Clean-up and restoration of damaged systems</b></p> <p>Where both the above levels of management have failed, strategies may be introduced to recover damaged ecosystems by:</p> <ul style="list-style-type: none"><li>• extracting and removing pollutant from ecosystem</li><li>• replanting/restocking lost or depleted populations and communities.</li></ul>

# Eutrophication Management

Find the next clean page in your book and orientate as landscape

Pick a partner to discuss with

Match the management strategy to the actions (connect with lines)

Evaluate the management actions - write which you think are most useful with a justification e.g. because, based on:

- Initial Cost
- Time taken to solve issue
- Long-term costs
- Time taken to implement
- Ease of implementation e.g. expertise, technology
- Sustainability of solution e.g. how long the solution will be effective