STORMWATER PONDS: MORE THAN MEETS THE EYE

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MORPHUM ENVIRONMENTAL LTD

TODAY'S PRESENTATION

- BACKGROUND
- LAND DEVELOPMENT AND PONDS
- IMPACTS
- CHALLENGES OF POND OPERATION AND MAINTENANCE
- POSSIBLE SOLUTIONS

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Stormwater Ponds

Minimising flooding downstream

Improving water quality

Reducing downstream channel erosion

LAND DEVELOPMENT AND PONDS

Stormwater management is a principal factor in the planning and design of urban development.

Resource consents require effects mitigation,

Ponds have been used to mitigate the adverse affects,

Land development is complex and ponds have been used as a simple capex-optimised solution.

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LAND DEVELOPMENT AND PONDS

Stormwater ponds are an end of pipeline solution.

Ponds often encourage planning of developments to have the maximum allowable impervious coverage.

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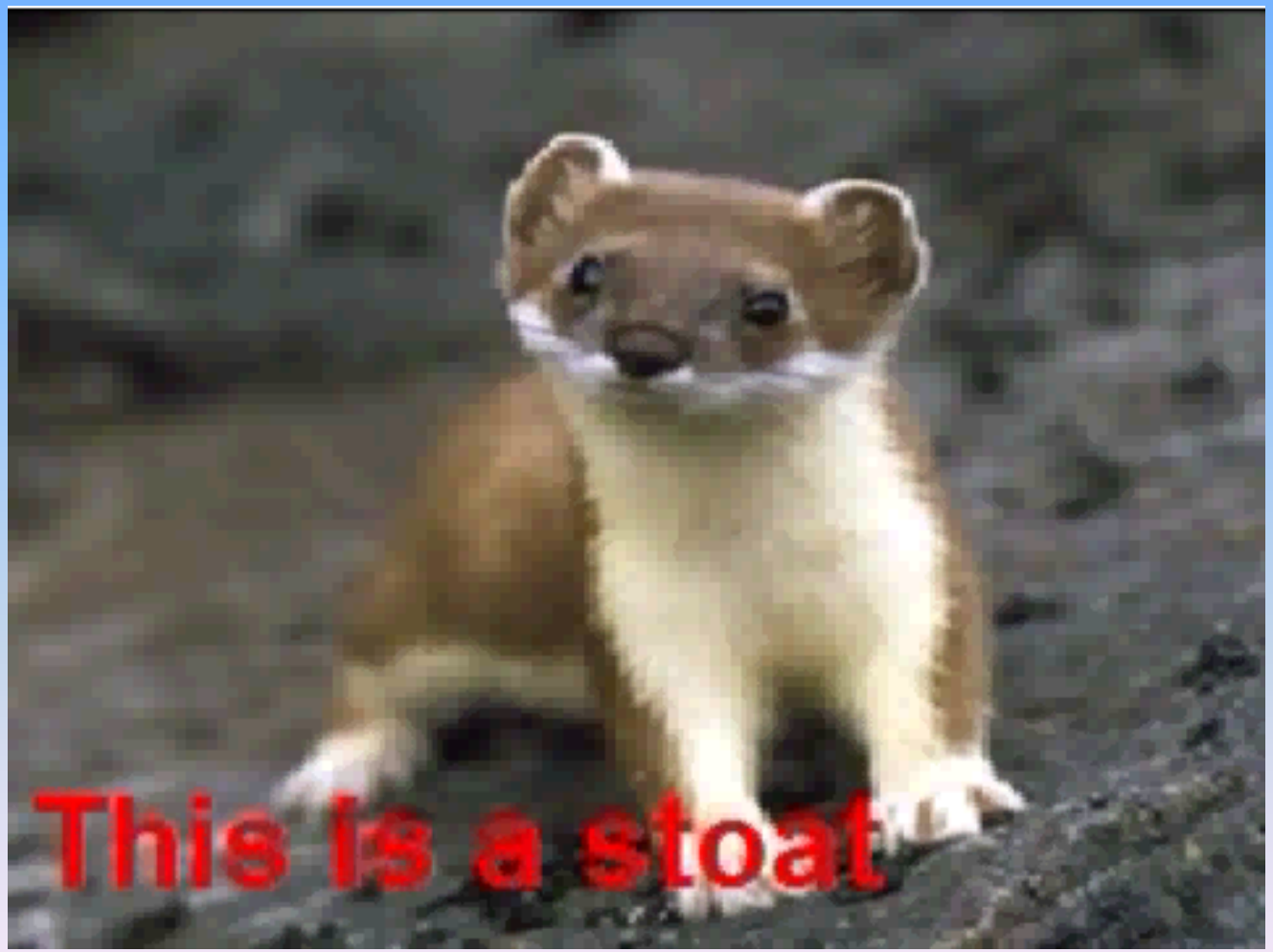
Fundamental change in planning to minimise impervious cover in catchments ?


This is a stoat

WHY ARE PONDS A PROBLEM

HYDROLOGY

- Ponds can be designed to limit peak flows,
- Do not address total runoff volumes,
- Longer duration peak flow events,
- Potential to stress in-stream fauna and have adverse environmental affects,
- Technical constraints in reducing volumes.

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IMPACTS

ECOLOGY

- Ponds can contain complex dynamic ecosystems,
- The management of ponds for ecological values is often poorly understood and applied,
- The footprint of a pond modifies the ecological setting,
- Online ponds are constructed on the bed of perennial waterways resulting in habitat loss,
- Accumulation and potential bioaccumulation of persistent pesticides, herbicides and heavy metals can impact organisms,
- Changes in carbon and nutrient loadings also cause shifts in stream trophic status.

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IMPACTS

AQUATIC WEEDS

- New Zealand was not well represented with aquatic plant species prior to European colonisation,
- Changing landuse resulted in habitat disturbance and invasive species taking advantage,
- North Island streams and rivers in developed urban catchments are now dominated by introduced plants,
- Ponds offer an optimal habitat type for many invasive aquatic species.

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Many of these species reproduce vegetatively,
and during maintenance can spread downstream.


Infestations peak during summer then crash,
Mass of growth reduces flood storage volumes,
Large rafts of weeds can block service outlets
resulting in potential flooding.

IMPACTS

Fish

- Pond outlet control structures may form barriers to the passage of climbing and non-climbing species.

- Ponds are an ideal habitat for many introduced fish species. Some of which have since become pests such as Koi carp (1960) .

- Liberation of aquarium fish and spread through capture and release,

- During storms, many of these exotic species are washed downstream and establish.

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Mosquito fish, introduced in the 1930's to control mosquito larvae, have infested many stormwater ponds.
They are found down stream of the many of online stormwater ponds.

THERMAL IMPACTS

- The thermal impacts of ponds are not often considered and can reduce water quality,
- The permanent pool acts as a heat sink during the summer months,
- On-line ponds are known to cause significant increases in water temperature, often for hundreds of meters downstream,
- Incoming solar radiation is absorbed by sediment particles which conduct heat into the water.

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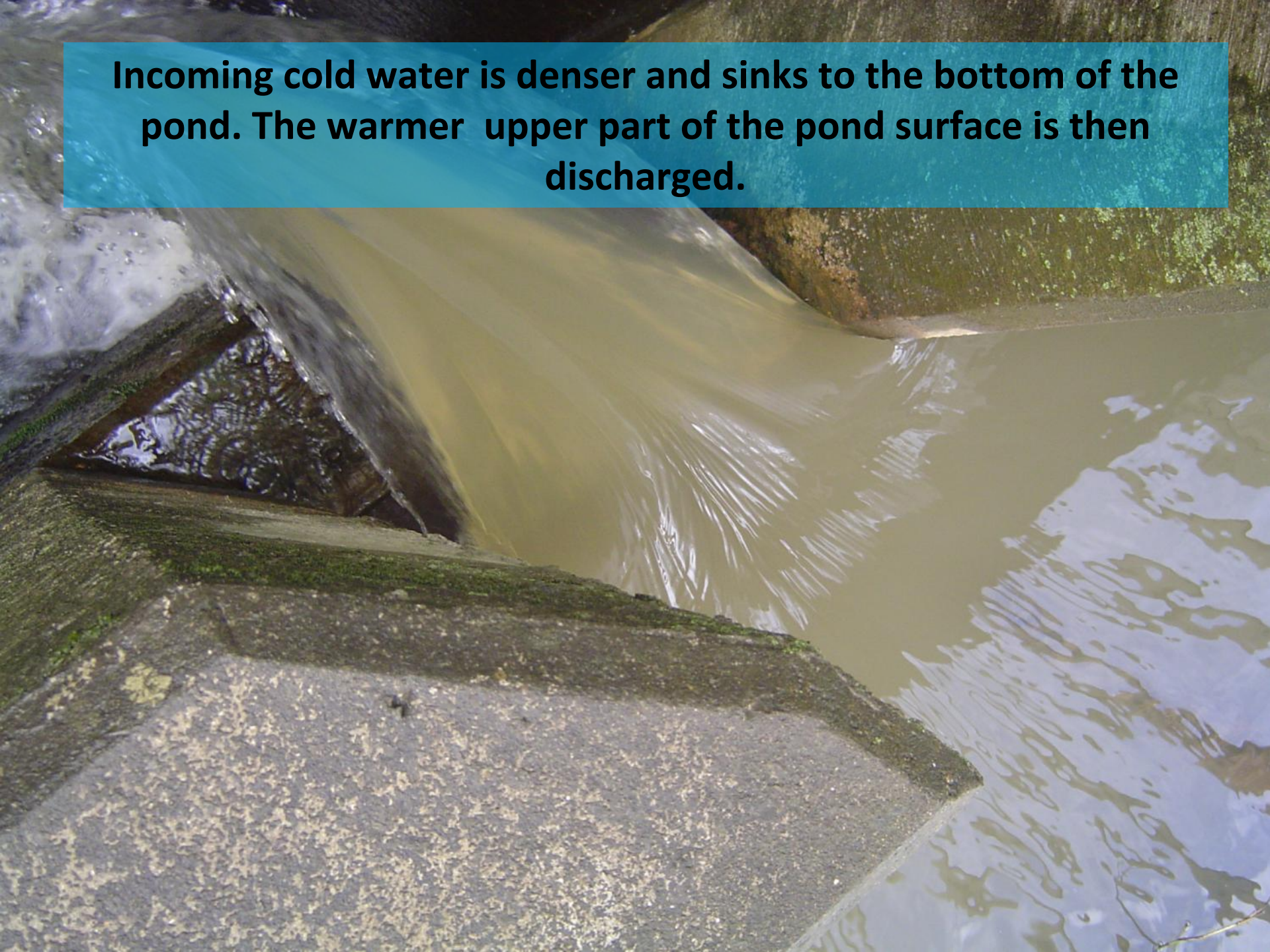
Incoming cold water is denser and sinks to the bottom of the pond. The warmer upper part of the pond surface is then discharged.

DISSOLVED OXYGEN

- Decomposing algae, weeds and organic sediments result in decreased dissolved oxygen concentrations - stressing downstream fauna,
- Sensitive aquatic macroinvertebrates such as stoneflies and caddisflies can be affected by these changes,
- Increases in temperature as a consequence of thermal impacts also act to reduce dissolved oxygen levels.

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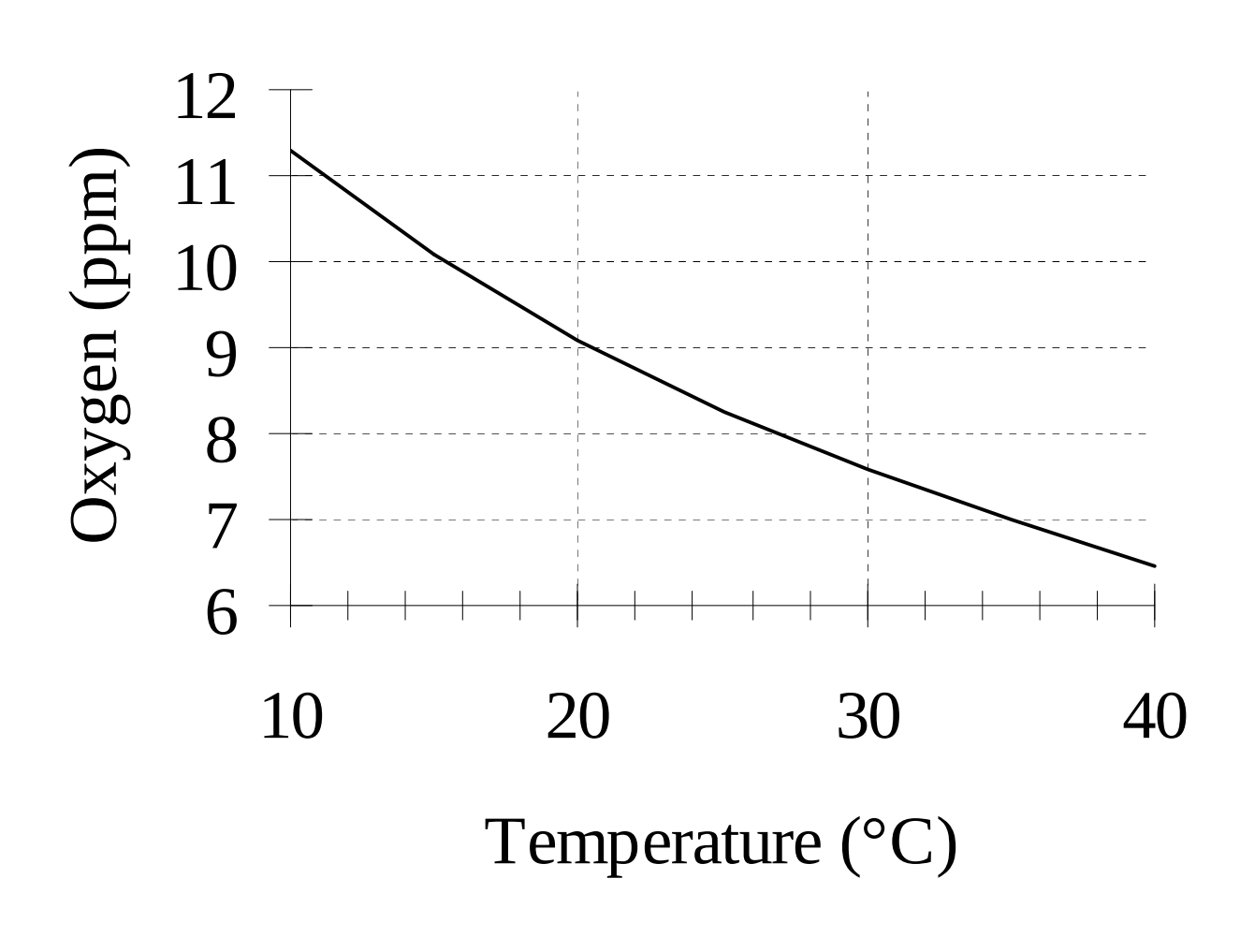
DISSOLVED OXYGEN SATURATION



CHALLENGES OF POND OPERATION AND MAINTENANCE

MAINTENANCE AND MONITORING

- Stormwater ponds require regular maintenance and inspection,
- Maintenance plans should include descriptions of monitoring procedures including frequency and methodology,
- Monitoring the accumulation of sediment in ponds is an important part of maintenance planning.

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Detailed measurement of the accumulated material (cost planning)

Data to understand pond performance

CHALLENGES OF POND OPERATION AND MAINTENANCE

SEDIMENT REMOVAL

- Sediments built up over time,
- Treatment efficiency and flood mitigation function reduced,
- Cleanout every 2-10 years for pond forebays and 10-50 years for the main pond area,
- Disposal of sediments requires testing for landfill acceptance.

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Access to ponds is extremely important as costs may increase for cleanout

CHALLENGES OF POND OPERATION AND MAINTENANCE

COST OF SEDIMENT CLEANOUT

- The future costs for sediment removal should not be underestimated,
- Assuming 350 ponds in the Auckland region with 500m^3 per pond to be removed over the next 25 years, the maintenance cost in today's terms could be $122.5 million,
- Cleanout programmes are behind schedule, with prohibitive costs being the limiting factor.
- To meet water quality objectives ponds must be cleaned out,
- Removal costs are also associated with other treatment options; therefore in order to avoid these costs control at source should be considered.

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POSSIBLE SOLUTIONS

- Improvements in forebay design to trap more sediment and reduce costs,
- The use of treatment train approach to reduce pond loadings,
- Construct dry weather baseflow bypass channel,
- Increase shading through specimen tree planting and North to South alignment,
- Incorporating floating wetlands in pond treatment systems to increase shading and metals removal,
- Existing ponds being redesigned and retrofitted as wetland pond systems.

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POSSIBLE SOLUTIONS

- Construct a deep water release pipe at the service outlet to avoid thermal impacts,
- Retrofitting fish bypasses to outlets,
- Include biological monitoring in inspection regimes,
- Community education planning to control deliberate and accidental releases of invasive species,
- **Fundamental change in planning to minimise impervious cover in catchments.**

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Avoiding the use of ponds in the first instance, while potentially more challenging, may provide a better blueprint for the future.

Questions

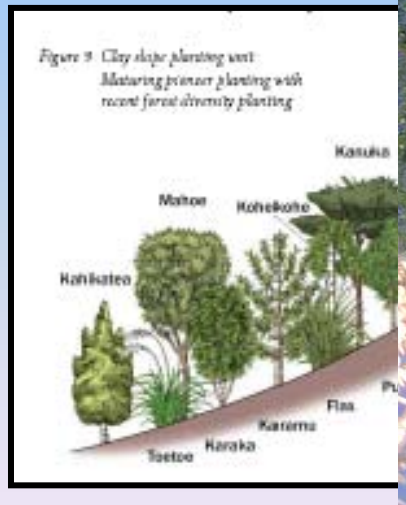
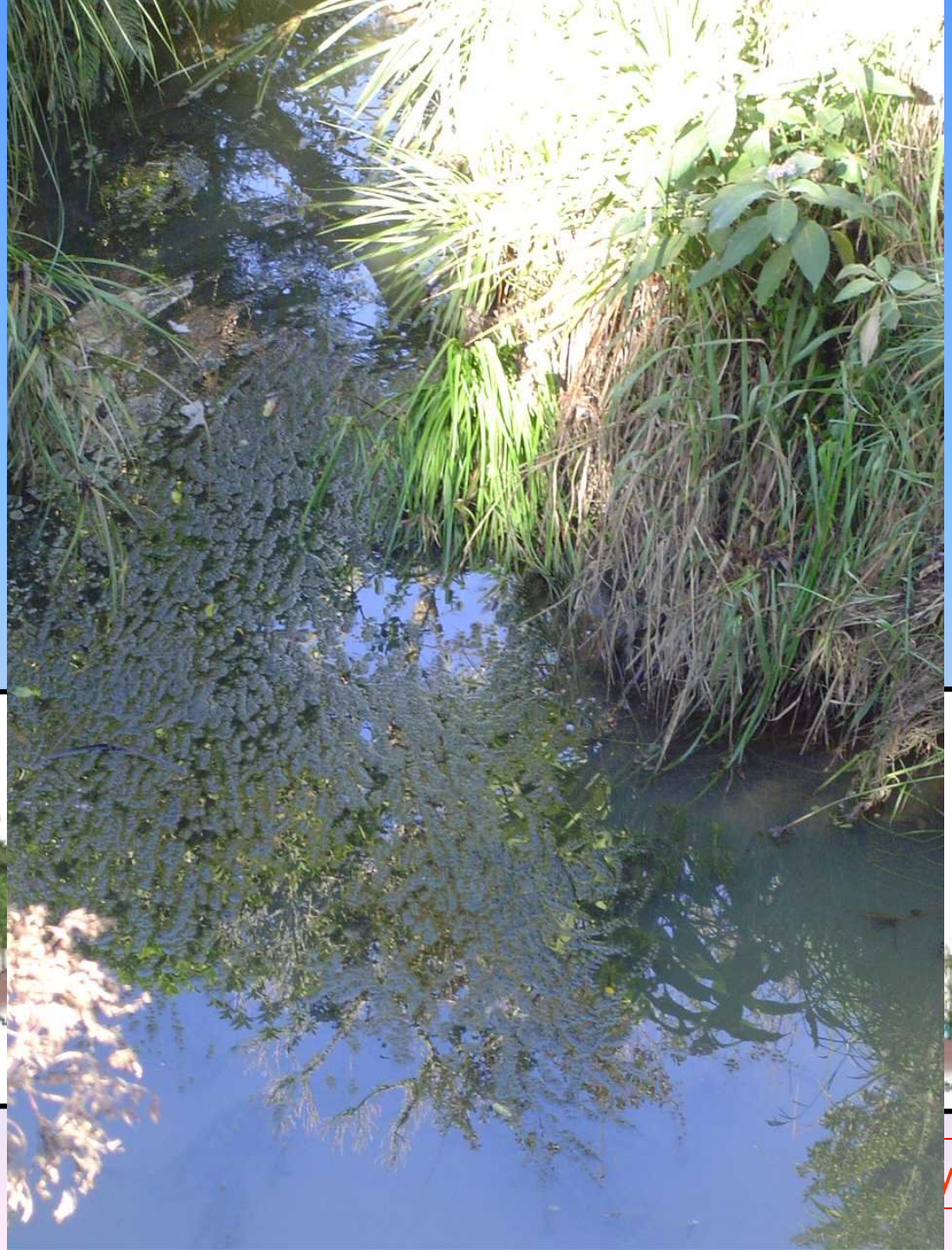
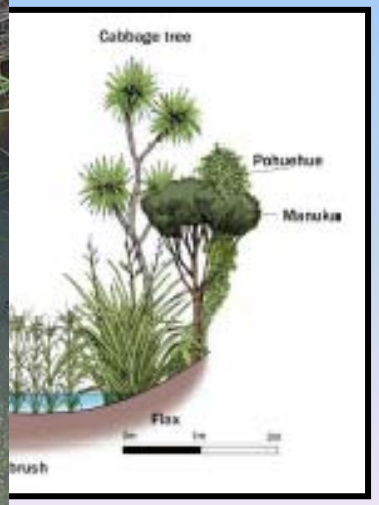


Figure 9 Clay slope planting unit
Maturing pioneer planting with
recent forest diversity planting
Kanuka
Mahoe
Kohekohe
Kahikatea
Flax
Karamu
Karaka
Toetoe




Cabbage tree
Pohuehue
Manuka
Flax

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